THE

ELECTRICAL REVIEW.

VOL. XLVII. JULY 13, 1900. No. 1,181.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1900

Edition.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone No. 933 Holborn.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13, Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

AMERICAN ENGINEERS IN ENGLAND.

DURING the past two or three weeks this country in general, and London in particular, have been visited by a large number of American engineers. We need hardly say how welcome they have been, and we may, to some extent, forgive our French neighbours for their attitude toward this country when we reflect that, as in 1889, the critical factor in fixing a visit of American engineers *en masse*, has been a Paris Exhibition. We wish, however, that such visits could be more frequent and that they could be reciprocated. We believe that fraternising of this kind will teach both English and Americans how little is the real difference between the two great Anglo-Saxon empires and the best of their people.

In connection with the American Engineers' Convention in London, there was for a fortnight a round of visits and receptions, and none was better attended or more appreciated than that of July 3rd, when a large party was taken to Windsor by special Great Western train, and accorded the privilege of viewing the Castle—a special privilege considering that Her Majesty was in residence. Moreover, in a sense, the freedom of the Castle was granted to the visitors, who were free to wander at will through the rooms and chapels, not being conducted by a guide in the usual way. Further still, Her Majesty provided refreshments in the Orangery, and, to crown all, drove slowly through the crowd assembled in the Park below the Terrace, and received the Presidents of the American Society of Civil Engineers and the American Society of Mechanical Engineers, and extended a welcome in a few words. All our visitors were much gratified at this proof of Her Majesty's kindness and consideration, which, as we all know, never fail.

Our visitors were welcomed by the President at the reception of the Institution of Civil Engineers, which was held in the Guildhall of the City of London, and, despite the denseness of the crush, was a pronounced success. The Guildhall lends itself especially to such functions. Its library is replete with books and manuscripts and ancient charters, that record the history of our old city from its earliest times. A concert by the pupils of the Royal Academy of Music was held in the Council Chamber. The string band of the Royal Artillery played in the Great Hall, and there was vocal music in the Library and Art Gallery, the pictures in which are this year of, perhaps, more than usual interest.

Next to the day at Windsor, the excursion to Warwick and Stratford was, perhaps, most fully attended. A special Great Western train left Paddington on Friday, July 6th, for Warwick. The visitors were not only received by the Earl and Countess of Warwick, but were conducted through the Castle by the Countess herself, who, with the Earl, graced the luncheon table by her presence, and also spoke a few words of welcome. From

Warwick the special ran forward to Stratford, and brief visits were made to the church, to the memorial theatre, and to Shakespeare's birthplace. We need not describe either Stratford-on-Avon or Warwick Castle.

To those who could appreciate it, the run home of the special from Stratford to London was in itself a treat. It was drawn by the first of the latest class of Great Western engines, a monstrous engine with a huge boiler and Belpaire firebox. The visitors were looked after by Sir Douglas Fox in a most untiring manner. Space does not permit us to refer at length here to the week's previous entertainment by the Institution of Mechanical Engineers, to many pleasant incidents inter-leaved in the main programme, or to a private function to which we allude in another place; but we believe that such interchanges of ideas and hospitality between representatives of the two countries must necessarily foster a more brotherly feeling between them; and there can be no two opinions, but that the engineers and scientists of England and America are truly representative of the two greatest engineering nations of the world.

GAS ENGINES FOR ELECTRICAL PURPOSES.

Though the production of electrical energy by means of gas engines has been placed somewhat under a cloud by experiences at Belfast, Coatbridge, Lynn, and Leyton, it is probable that the appearance of the Westinghouse engine at the recent Tramways Exhibition at the Agricultural Hall will cause many very seriously to inquire whether the above-named installations have been laid down in such a manner as to be expected to command success. The triple Westinghouse engine above referred to was, it is true, not doing very much work, but it ran steadily, and there is no reason why it should not continue to do so up to the maximum possible limit of gas supply.

In some respects the gas engine is particularly suited for electrical traction work. A heavy fly-wheel is always provided. In the case of a regular load there must be some margin of power beyond the load. The very smallest amount of overload will stop the engine, for there is a fixed maximum of gas inlet beyond which it cannot go. Thus a gas engine must have a margin of power available beyond the maximum it may be called upon to perform. Let it be considered for a moment how this affects the engine when applied to traction work. Experience in the working of tramway power stations points to the fact that there is a certain ratio between the mean load on the station and the maximum. This ratio varies in some way not yet clearly ascertained, and the most that can at present be stated is, that the variation is greatest in the case of the smallest stations, and is dependent very closely upon the total amount of energy generated in a given time. Approximately, this ratio or load factor can be foretold for any proposed station not too far removed in size from existing examples, and the maximum current demand, setting aside the results of accidents, such as short circuits, may also be anticipated, and will not exceed 20 to 25 amperes per car in the case of a line of, say, 50 cars. Moreover, the maximum demand is usually of very short duration, and is generally followed by a demand that does not exceed 60 to 70 per cent. of the maximum. Such being the case, it is probable that a gas engine, capable of producing, say, 80 kw. as a maximum, might be found capable of dealing with a peak of 100 kw., for the peak would be momentary; it would be dealt with by the fly-wheel energy superadded to the full effort of the engine, and it would cease before the speed of revolution had fallen very seriously below the normal.

We see no prospect of success for gas engines using other than producer or similar gas. Competition with steam is not possible where costly illuminating gas is employed. Obviously, then, the source of gas must be either a blast furnace, a coke oven, or a gas producer. Our experience of gas producers has taught us that many of these are made in a very slipshod manner. Although there is no pressure to be carried, a gas producer ought to be designed just as carefully, and should be made with the same regard to its mechanical fitness, as a steam boiler. Some we have seen are the very antithesis of this. Others again bear their value plainly written on them, and have been well made. Of necessity, gas producers of large size are in every way better fitted to secure success than are small producers. The blast furnace is an ideal producer, because from its large size and steady action it turns out a very regular product, and it may well be copied when designing smaller units. That is to say, the fuel depth, rather than the area of cross-section, must be large, and the square form should be avoided, because in a square producer the corners do not act well; they tend to irregular action and leakage of air, whereas the circular form conduces to regularity, and height helps sufficiently to consolidate the fuel and cause the production of carbonic oxide with a minimum of dioxide. The shallow furnace tends, on the other hand, to produce an excess of dioxide, and thereby greatly to impoverish the gas and to reduce the power of the engine supplied therewith. The system of governing by moderated charges is, we take it, the proper one to adopt with cheap gas. When the hit-and-miss method was introduced, the only gas was the dear stuff popularly known as illuminating gas, and it was, perhaps, justifiable to employ the hit-and-miss governor for the sake of the greater economy over the system of moderated charges. The fuel cost is, however, not so different with producer gas as to demand the economical method in preference to the more regular method now coming into use; and where blast furnace gas is employed, the demand falls so far below the supply that no question need arise; this gas, in fact, is almost entirely waste.

It is an astonishing fact that, with millions of horse-power blazing to waste, no effort is made, except by a very small number of ironmasters, to bring about the useful employment of gas power. As we have before pointed out, each pound of fuel consumed in a blast furnace will, after it has done its work of producing iron, render up by means of gas engines power of greater amount than if converted into steam power by means of steam engines of the highest class.

Seeing then that it is always desirable that a gas engine should somewhat exceed its maximum ordinary steady load, it appears not unsuited to deal with the varying load of

a traction station, especially when the very transitory maximum load can be negotiated by the energy of the fly-wheel. Considering the very extended employment of gas engines, we cannot but think that a careful inspection by some expert motive power engineer of the cases of non-success would reveal causes sufficient to account for the failures of which so much has been heard. Gas power has for years dealt effectively with the pumping of town water supplies and the water supplies of public institutions. It is used in private electric light installations, in the manufacture of carbide of calcium, and in blowing the blast of blast furnaces. Its economy is so obvious that it is entitled to consideration.

MUNICIPAL TELEPHONES.

At the annual dinner of the Municipal Electrical Association at Huddersfield, Sir J. T. Wodehouse, M.P., replying to the toast of "The Guests," spoke eloquently on municipal enterprise generally, and expressed his agreement with the policy of giving to communities the power of themselves undertaking the telephonic service. The Government had deemed it unwise to increase the number of civil servants by taking over all those employed in telephonic work; 95 or 98 per cent. of the messages were local messages only. He believed, from all he knew on the subject, that the municipalities could work the service at one-third the price subscribers had to pay at the present time, and the service could be made more efficient.

At a time when the scope of municipal enterprises is under the consideration of a Parliamentary Committee, these remarks of Sir J. T. Wodehouse will meet with much consideration. Whether or not the fear of increasing the number of civil servants has influenced the present Government in their telephonic policy, it was certainly given as a reason by Mr. Goschen for not acquiring the service some years ago. A future Government may not be influenced by the same reason. We think that care should be taken that the stated percentage of local calls does not mislead. If we are not mistaken, the percentage relates to telephone areas, and telephone areas are not identical with municipal areas. Moreover, whilst the percentage may represent the percentage at the moment, it should be anticipated that with the extension of long-distance lines and the growth of the telephone service the percentage of local calls must be reduced. Telephone service should follow other means of communication in being of an ever-widening nature. It is likely thus to become rather of a national than of a municipal character. The necessity of uniformity, the advantage of central control, may be sufficiently apparent to overrule, in the minds of a future Government, the objections to an increased Civil Service. It is certainly desirable that municipalities should require definite evidence that the service can be furnished at so cheap a rate as Sir J. T. Wodehouse states. It is certain that municipalities will have to learn from experience how much, or how little, telephone service costs, and this experience will not be gained for nothing. The growth of expenditure, which is a necessity of telephonic expansion, will be certain to influence the members of municipal bodies, to the possible disadvantage of the service. The main consideration which brings telephone service within the field of municipal undertakings is the control of the streets, but this can be met either by private enterprise or national control. Telephone service is not a necessity like water or light. For some time to come the subscribers to a telephone system must remain a small minority of the community. These considerations should tend to make municipalities somewhat doubtful of undertaking the work, especially as in the majority of cases it must be done in competition. The telephone is one branch of the system of communicating intelligence, and sooner or later, should in this country come under the same control as the telegraphs and the letters. It is doubtful whether this control can be so long delayed as to make municipal undertakings a useful stepping stone or a profitable enterprise.

Workmen's Compensation Cases.

We published a fortnight ago a short article dealing with the proposed extension of the Workmen's Compensation Act. Many of the cases which have been discussed in the Courts, and notably the two which have recently been decided in the House of Lords, seem to show that before extending its application, the Government would do well to amend the Act. Thus it is a matter of common knowledge that compensation may be claimed by those who are "wholly or partially dependent" upon an injured workman. The legislature shirked the responsibility of defining the word "dependent," and in the case of Davies *v.* the Main Colliery Company, the final appeal court have decided that it is a question for the County Court judge. In the case under notice, his Honour had held a father to be partially dependent upon his son, who lived at home and paid his wages to the common fund! The solution of the problem, therefore, appears to depend upon the charity of each judge of the County Courts. Another instance of faulty or insufficient wording has caused much diversity of judicial opinion, and great cost to the unfortunate employers. It was laid down in the Act that "a claim for compensation" must be made within six months of the accident, or, in case of death, within six months of death. The Main Colliery Company thought that unless the workman instituted legal proceedings within that time he was deprived of his remedy. Two judges of the Court of Appeal, and Lord Morris in the House of Lords, were also of this opinion, but the majority of the House of Lords took the opposite view. The result is that if a workman makes a claim of some kind (which, apparently, need not be in writing), at any time within six months, he may defer the institution of legal proceedings until such time as he may think fit. Seeing that the workman who seeks redress under the Employers' Liability Act must commence proceedings within six months, it was not unreasonable to suppose that the same limit of time was put to proceedings under the Workmen's Compensation Act. The net result of all this litigation is that employers, in addition to making payment of compensation on a large scale, have had to pay dearly for very reasonable attempts to interpret a difficult Act of Parliament.

Electrical Engineering in New Zealand.—We read in an Adelaide paper that a school of electrical engineering is about to be opened in connection with the Canterbury University College. Ovor £2,000 is now available for expenditure in appliances.

ON THE PHOTOMETRY OF ARC LAMPS.

By F. W. CARTER, M.A., Cantab.

When we consider the keen rivalry that exists between the gas and electric supply industries, and that the factor which decides a user in favour of one or other of these as illuminants is, in a very large number of cases, that of efficiency, it is somewhat surprising that supply companies and engineers to the authorities having charge of public lighting do not generally make tests of their arc lamps, to see whether they have efficient ones from a light-giving point of view, or are running them with the best quality and most suitable size of carbons, or have them enclosed in the least absorbent globes, nor yet of their glow lamps to determine their efficiency, their best paying "life," * and the most effective shade for use with them. There is no doubt that if light were sold

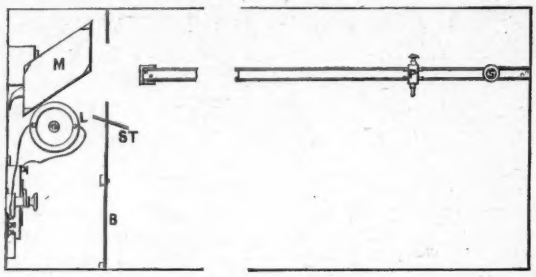


Fig. 1.—Plan of Photometer Room.

by its appropriate units of candle-hours instead of by Board of Trade units, the photometer room would be among the most important testing rooms of every central station.

It is notorious that different batches of carbons of the same make, and professedly the same quality, differ largely in their light-giving powers as well as in the steadiness of the light given. An ordinary arc lamp globe, again, absorbs from 30 to 40 per cent. of the light of the arc, (though a new ground glass globe only absorbs about 20 per cent.), whilst the effective absorption, as far as the downward light is concerned, is, with continuous current arcs, even greater. If, then, two types of globe differ by 5 or 10 per cent. in their absorption, the use of the least absorbent increases the effective output of the plant for lighting purposes by this amount. A study of the shape of the photometric curve of a lamp enables a predetermination of the lighting effect to be made with considerable accuracy,† and is necessary if the lamps are to be used with best effect. The shape of the curve depends largely on the length of the arc, its bulb being longer and nearer to the vertical with long arcs, though the efficiency of the arc, as distinguished from that of the lamp, seems, according to some experiments of the author's, to be practically independent of the length, at any rate within the usual limits for open arcs.

Thus from every point of view the photometry of arc lamps is important, and would doubtless be more extensively practised were it not for the difficulty of the tests, and the consciousness of the unreliability and general unsatisfactoriness of the results when they are obtained. As ordinarily practised, the photometry of arc lamps can hardly be relied on to give results much within 10 per cent. of the truth, and such results are quite useless except to give a general idea of the distribution of light from the arc, for the errors may be greater than the differences we are chiefly concerned with.

If it were possible to surround an arc with a working model of its photometric surface, we should find, as the arc hisses, and spurts, and feeds, and travels round the carbons, that the surface is in a state of continual perturbation and distortion from its assumed symmetrical figure, suggesting to the onlooker that it is the cage of a small whirlwind.

Besides having to cope with the difficulties arising from the changes in the arc, the operator usually has to attempt the impossible, in that he generally compares the light with one of totally different quality, which can no more be done than the comparison of the loudness of two different notes on a piano, or of the greatness of Newton and Milton. He seeks, in short, the position of the photometer which gives equality of two illuminations *which are never equal*.

A gas lamp at a certain distance may be as good as an arc lamp at a certain other distance, for the purpose of reading a newspaper printed on white paper; but the former would be found superior if the paper were pink, and the latter if it were green, so that the most efficient form of light for a person to use may depend to some extent on his political opinions. Lights of different colours cannot be equal for all purposes, and for this reason no process of oscillating the photometer or standard, and no effort of judgment will enable one to determine the relative intensities of two such lights as a gas lamp and an arc lamp; neither will the use of coloured glasses give us any usefully interpretable results.

The present paper is the result of some experience in such tests, and is intended to show how to carry them out, and to give details of some devices of the author's for overcoming the difficulties of the subject, and for placing the results on some rational and certain basis.

The underlying principles of photometry are exceedingly simple, and as long as we are dealing with lights of the same colour the practical difficulties are not great, being chiefly connected with preventing the two lights from varying, and keeping the standard true to its nominal value. Given steady lights of the same quality, the better the photometer used the more accurate are the results of the comparison, but for use with such lights as we are dealing with, a Lummer-Brodhun photometer is not a bit better than a Rumford, Bunsen, Joly, or any of the simpler forms of photometer.

The first requisite for the photometry of arc lamps is plenty of room, especially when the measurements are made with the lamps running under working conditions—that is, with globe and reflector on; for in assuming that the illumination varies inversely as the square of the distance from the source of light, we are assuming that the light emanates from a point, and so must take care that all our measurements are made at distances from the source which are great compared with its linear dimensions. Apart from this, however, the great power of the light, compared with any ordinary standard, makes it necessary to use a long

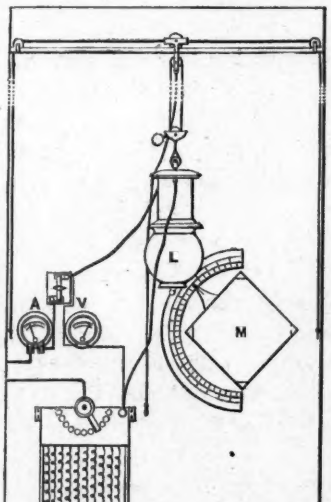


Fig. 2.—Elev. as seen from Photometer.

photometer bench, in order that one may not be obliged to work too near to the standard, whose size will render untrue the law of inverse squares; besides, a given error in the reading will make a much larger error in the candle-power, when the bench is short, than would be the case if it were longer. Furthermore, the tests are made more easily and more accurately when the illumination of the photometer is moderate in amount than when the eye is highly stimulated by excessive brightness. A deficiency in the length of the photometer room can to some extent be made up in width, since it is necessary to turn the path of the light from the arc through a right angle by means of a mirror, and there is

* See Electrical Review, August 19th, 1898.
† See Electrical Review, December 22nd and 29th, 1899.

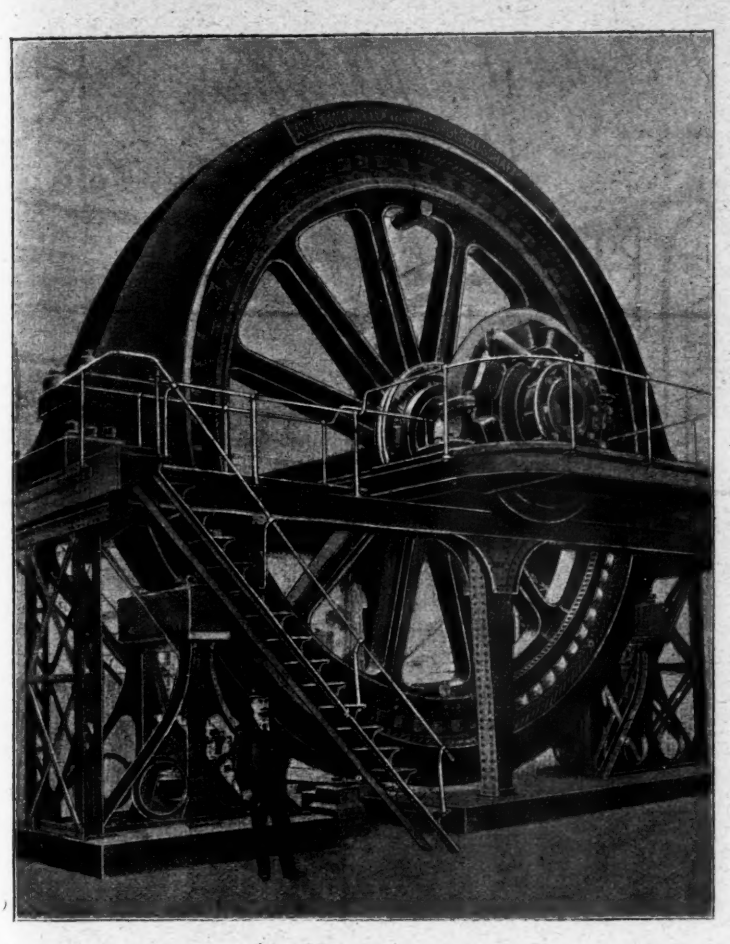


Fig. 1.

little objection to having 6 or 8 feet of the path on the lamp side of the mirror; the room, however, must, in this case, be high enough to allow the arc to be raised this 6 or 8 feet above the mirror. If the room is a long one (say, 10 or 12 yards), it is better to arrange that the arc shall be about 2 feet 6 inches from the mirror—just so far, in fact, that there is no difficulty in screening off all the direct light of the lamp from the photometer without cutting off any reflected light. There is some advantage to be gained by always keeping this distance the same, as we can then mark the bench so as to read distances from the arc directly. A passage 6 or 8 feet wide, 12 feet high, and 12 yards or so long, will make an excellent photometer room. The walls and ceilings (and especially the end walls) should be dull black in colour, an effect easily produced by means of a wash of vegetable black and size. The photometer bench, screens, &c., should also be painted dull black.

The simplest arrangement of apparatus is as shown in figs. 1 and 2.

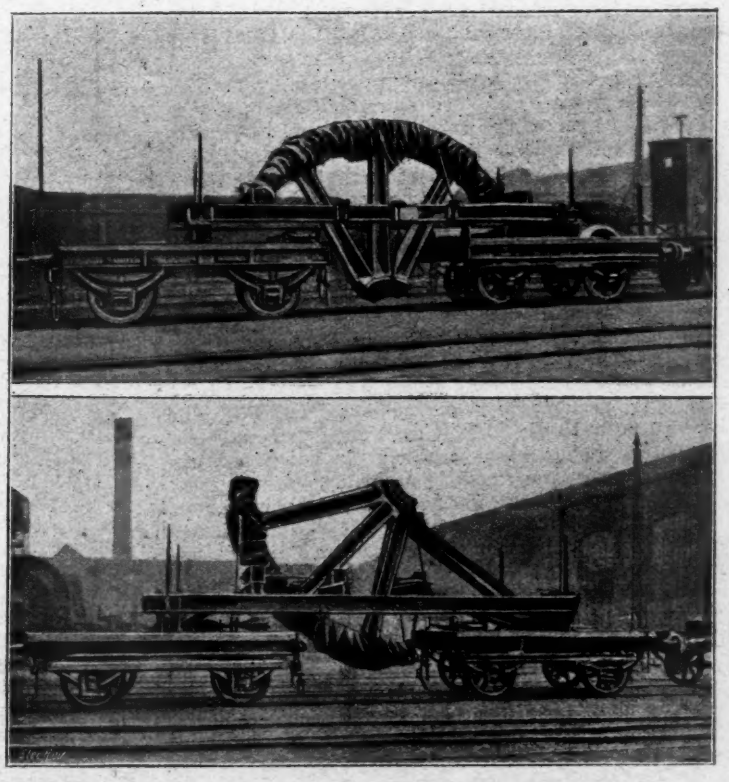
The lamp must be so slung that it can be moved in a circle about the mirror. It may be given a vertical motion by means of a rope and pulley, and a horizontal one by hanging the pulley from a trolley running on a horizontal rod placed near the ceiling, parallel to the end wall, and at a distance from it equal to that of the centre of the mirror. The rope giving the vertical motion should have its free end attached to the lamp rather than to the wall, as this renders the two motions dependent on one another. The arrangements for moving the arc are shown in fig. 2. The lamp can be placed roughly in position by eye, and a finer adjustment then made by means of sighting tubes, one—a movable one—looking along the bench on a level with the centre of the mirror, and another, at the same height, passing through the screen, B (fig. 1), as at S T; this should look at the correct position of the reflected image of the arc. The position of the lamp is adjusted until the image of the arc is seen through both tubes.

(To be continued.)

THE A.E.G. 3,000-KILOWATT ALTERNATOR AT THE PARIS EXHIBITION.

We give herewith an illustration of the large three-phase alternator which the Allgemeine Elektricitäts Gesellschaft are exhibiting in the German annexe of the Paris Exhibition. The machine gives 3,000 kw. when running at 83 revolutions per minute, the frequency being 100 per second. The fly-wheel is 7·4 metres diameter, and has 72 poles, which are laminated and held in position by cotter keys as described in Mr. E. K. Scott's article in the Electrical Review for May 4th, 1900.

The diameter of the armature is 8·6 metres, and its weight 80,000 kg. The fly-wheel and poles, &c., weigh 70,000 kg.,



Figs. 2 & 3.

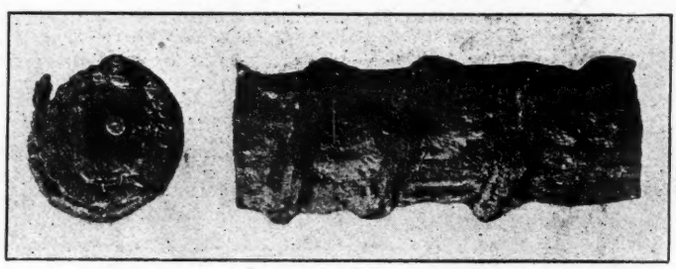
and the bedplate 10,000 kg., making a total weight of 160,000 kg.

Special wagons had to be employed to transport the machine to Paris, the armature and the fly-wheel being each divisible in four sections. Figs. 2 and 3 show fly-wheel sections on their way. The machine is for the Berliner Elektricitäts-Werke, and will be driven by a horizontal four-cylinder triple-expansion engine.

THE FIRST SUBMARINE CABLE.*

By W. F. BRADSHAW, Jun.

The first successful application of submarine telegraphy undoubtedly was due to Cyrus W. Field, of New York. But the idea and the first practical application of it, as Mr. Field himself has generously acknowledged, must be credited to John Boyd Sleeth, a Tennessee River steamboat captain.



A PORTION OF THE FIRST SUBMARINE CABLE.

Captain Sleeth was born at Allegheny, Pa., November 21st, 1826, and died at Paducah, Ky., March 12th, 1895. For several years he was on one of the old "broadbow" boats that plied on the Mississippi and Ohio Rivers. Then he settled at Paducah, and in 1845 was in the employ of Mr. Tal Shafner, who had charge of the telegraph line at Paducah, which connected St. Louis and Nashville. The Ohio, at Paducah, is something over a mile in width, that being the point of its confluence with the Tennessee. The rivers meet at an acute angle, and the backbone ridge between them breaks opposite the city into two islands. It was by means of one of these islands that Mr. Shafner found it possible to run his line across both rivers. He erected tall staffs, one on the Kentucky shore at Paducah, another on the islands, and a third on the Illinois shore. The wires of the line across the Ohio at Paducah were strung upon lofty poles high above the stacks of passing steamers, which cleared the line in low water seasons, but struck the sagging wires and tore them down when the rivers rose. Great difficulty was experienced in keeping the wires sufficiently high and taut to avoid such accidents. Young Sleeth knew something of the principles of insulation, and the idea of laying an insulated wire across the river bed occurred to him. His idea was received with some scepticism by Mr. Shafner until he proved its feasibility by experiment. About a year later the local management consented to let him make the experiment of running an insulated wire across the river. The work of insulating the wire was slow and uncertain; little was known about insulating materials, and the workmen were "day" labourers, entirely ignorant of the nature of the task, who had to be watched incessantly. One of the eye witnesses, Captain Wes Cooksey, has given the following description of the manufacture of the first submarine cable:—

The wire chosen for use as the cable proper, one strand, was stretched along the float and wrapped first with canvas, such as was then used for roofing steamers. The canvas had been soaked thoroughly in hot pine tar pitch. The covering process was continued until the wire was about half an inch in diameter and then it was guarded by a wire of a slightly smaller size, this being placed parallel, as is now the custom. It was then wrapped by loose coil with another wire of the same size. The number of wires laid parallel to the cable outside of the canvas insulation was 18. The cable was made in sections, which were joined before being laid. Just how long it took to complete the insulation is not known, but it was several months. The cable was over a mile long, and when laid was reeled off from the end of a large "broadbow" boat in tow of a steam craft. The work of laying was attended with some difficulty and required several days. The first test was very successful, and the wires worked admirably for several weeks; then the pitch insulation, of course, became water-soaked and the cable began to "stick," as the operators say, and was soon abandoned as worthless. But the idea had proven practicable, provided a better insulation could be found. Some months later Mr. Field sent a representative to Paducah to see Mr. Sleeth. An offer was made him to continue his investigations, and form a partnership. Mr. Sleeth was then in very moderate circumstances and had to decline the offer. The local management went back to the overhead wire, and the unsuccessful cable was soon forgotten.

Mr. Sleeth returned to boating, and was soon after made captain of a Tennessee River steamer. He fought through the civil war in the Confederate service under General Roddy, and came out a captain. After the war he went back to the river. Strange to say, he never patented his cable, or made any attempt to do so, but abandoned it entirely after the first failure. Mr. Robert Sleeth, of Pittsburg, Penn., wrote to Mr. Field in 1891, asking him about the truth of the report of his having sent a representative to see the captain, Mr. Sleeth's brother, and discuss the idea of an insulated cable. Mr. Sleeth has the letter Mr. Field wrote in reply, acknowledging the facts as stated.

About three years ago the end of the cable was found on the Kentucky side of the Ohio River, during the low water in August, and the accompanying illustration is a photographic reproduction of a piece filed off and now in the possession of Mr. James B. Sleeth, of Paducah, son of Captain Sleeth.

* *Scientific American.*

ARRANGEMENT INTENDED TO PREVENT THE INTERCEPTION OF DESPATCHES IN WIRELESS TELEGRAPHY.

By Dr. D. TOMMASI.

We know that wireless telegraphy is open to the objection that it does not ensure secrecy in the messages sent, since any receiving apparatus placed within the zone of action of the electrical waves emitted by the transmitting apparatus may be influenced by them, and can consequently intercept the messages sent.

The object of the arrangement that I have designed is to prevent a message sent out by the transmitting apparatus of a telegraph station from being deciphered by a receiving apparatus placed at an intermediate point.

My invention is based on the fact that the distance to which the electric waves can extend varies according to whether the two metallic spheres of the oscillator are near together or not.

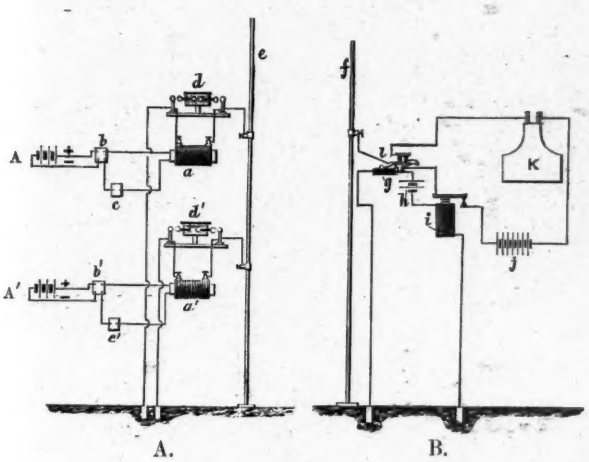
It follows, therefore, that by suitably varying the distance between the two spheres, *i.e.*, by increasing or diminishing the length of the spark of the oscillator, we can regulate pretty accurately the distance which the electric waves will have to cross in order to reach the receiving station of the line.

My arrangement consists in principle in combining the transmitter of the overhead line, which I will call A, with a second transmitter, A′, the manipulator of which, however it may be worked, sends out long and short emissions, which mingle with those of the transmitter, A, and the oscillator of which is so regulated that the zone of action of the waves sent out by the transmitter, A′, extends to a distance slightly less than that for which the oscillator of the transmitter, A, has been regulated.

Under these conditions the electric waves generated by the transmitters, A and A′, are so blended with one another that any receiving apparatus placed within the zone of action of A′, would only receive a confused quantity of dots and dashes from which it would be utterly impossible to eliminate the signals sent out by the transmitter A.

It will, therefore, only be possible to receive the signals sent out by the transmitter A, outside the zone of action of the transmitter A′. The more nearly the zone of action of the transmitter A′, corresponds with that of the transmitter A, the greater will be the security from interception. In order to obtain still greater immunity, we could combine with the actual transmitter, A, of the line several transmitters, A′, A″, A‴ . . . . regulated for various distances.

As shown in the accompanying figure the complete telegraphic apparatus comprises a transmitting station A, and a receiving station B.



The station, A, which constitutes the actual transmitter, consists of an induction coil *a*, on the primary circuit of which are introduced the interrupter *b*, and the manipulator *c*, whilst the secondary circuit ends at the terminals of the oscillator *d*, which communicates with the earth, and is connected with the mast *e*.

This station, A, contains besides a second transmitting apparatus A′, consisting of the same elements as the first, *i.e.*, of an induction coil *a′*, with an interrupter *b′*, a manipulator *c′*, and an oscillator *d′*, connected like the first with the mast *e*.

In this second transmitting apparatus the manipulator, *c′*, may be worked in any manner whatever, either by hand or mechanically, so as to send out at random long and short signals which will mingle with the signals transmitted by the manipulator *c*.

The manipulator of the second transmitter, A′, can also be kept lowered during the whole duration of the transmission of the message by the real transmitter, A, so that any receiver placed within the zone of action of the second transmitter, A′, will merely register a single continuous line. The space between the spheres of the oscillators, *d*, is regulated so that the electric waves sent out by this apparatus will reach the receiving station B; but on the contrary, that of the spheres of the oscillator, *d′*, is arranged so that the zone of action of the electric waves sent out by the latter shall be slightly smaller than that of the waves sent out by the transmitter of the actual oscillator A. Under these conditions, any receiver placed within the zone of action of the second transmitter can only collect, as has already been said, a series of dots and dashes from which the signals of the actual transmitter, A, cannot be deciphered.

The receiving station consists as usual of a receiving mast *f*, similar to the mast *e*, connected with a coherer, *g*, the electrodes of which are connected, one to earth and the other with a circuit passing through a battery, *h*, and a polarised relay, *i*, the function of which, when the coherer, *g*, is rendered conductive by the action of the electrical waves, is to close the circuit of a local battery, *j*, working a registering receiving apparatus, *k*, and the electric clapper, *l*, which is intended to bring the coherer back immediately to its original resistance.

CORRESPONDENCE.

Electrical Engineering in the Navy.

With reference to various opinions of the efficiency of the Navy published lately in your columns, and in which I have been greatly interested, I shall esteem it a favour if you can find space for the following: —

Having had the advantage of the experience of 10 years in the electrical branches of the Navy, and since, 10 years with several firms of electrical contractors, I feel sure that a fair view from both sides of the question will help to explain away many of the apparent objections to both the Naval arguments, and those of the electrical engineer. I quite agree with "R. T. I. C." that there is a very large amount of room for improvements by the Admiralty in things electrical, and that it is sorely needed, but, so far, it appears to me that those who write, have each written as from their own standpoint, without any consideration for the opposite sides, conditions or circumstances.

I mean that the electrical engineer of *terra firma* can know nothing whatever of the naval electrician, nor can the naval electrician know anything of the electrical engineer, except from hearsay.

It is quite evident that "R. T. I. C." has had very little experience of life on board a man-of-war, either as an electrician or otherwise, for his remarks have been the outcome of wrongly given information which he has relied upon.

The efficiency of the Navy from his point of view is much lower than zero, but I would strongly recommend him to pay a visit to our electrical training depôts, where he will find that everything that can possibly be acquired for the complete study of electricity in *all* its uses has been provided, and that some thousands (not hundreds) of officers and men pass through these schools annually, and are kept up to date, the scheme costing enormous sums to carry through, and many of the electrical engineers I have come in contact with have not had half the training or opportunities that our so-called "common seaman" has within his grasp, should he wish to tackle the profession and become either a seafaring, competent electrician, or even a scientific scholar. The days of seafaring ignorance are passed, almost every individual man being a fair scholar, &c.

It would be well if "R. T. I. C." were to take a turn round some of the electrically equipped vessels and make note when it will surprise him to find not only the leading torpedo man, whom he deplores, able to attend to things electrical, but that quite two-thirds of the whole ship's company are competent electricians, quite capable of all the duties that may be put upon them.

The root of the matter lately discussed by correspondents appears to be—who ought to be in charge of things electrical viz., the engineer, or the executive or "seamen," as I prefer to put it?

I honestly admit that it is impossible to separate electricity from engineering, and that the term electrical engineer is quite proper and in accordance with the profession, but nevertheless, the engineer does not necessarily require to know electricity to run a dynamo coupled direct to the engine, nor does the electrician require to know engineering to handle electricity, and where you have these two professions provided, of a necessity, for obvious reasons, then it must be admitted that a limit must be put upon the extent of the domain or duties of each.

The question then is, *where?*

Now, in the Navy it happens to be at the terminals of the dynamo; on *terra firma* it happens to be at either the lubricators or shafting.

According to "R. T. I. C.," the engineer wants to encroach further, to the switchboard, then the fuses, and then further still, even to the motors, until he has all there is electrical. Now this is wrong, as I will point out.

Can "R. T. I. C." show me any electrical plant of importance where the engine driver and stokers look after the switchboard, dynamos and circuits, &c.?

If so, cannot corporations reduce their staff salaries considerably by engaging such men?

It is just as absurd to make the naval engineer the electrician, as it is to make the engine driver of a Corporation plant responsible for the street mains and junction boxes, &c.

In fact, it is more absurd to do so, for a Corporation might possibly manage such a system, but the Navy could never do so.

Let me ask a few questions of "R. T. I. C."

1. Would it be correct to call up the engineers and stokers (there are very few engineer officers alone, and my remarks refer to officers and men) to fit up and man the ship's boats with the electrical apparatus used, and leave the ship and proceed to destroy the enemy's mine field, and finally blow up the forts and enable our fleet to enter the harbour? Who is to attend to the engines and boilers when one reflects that this operation often takes from 40 to 80 men to perform it? Surely "R. T. I. C." would not propose to put the seamen below and send the non-seamen afloat when they know nothing of seamanship?

2. If fortifying a harbour against attack, who should lay the submarine mines, booms, telephones, telegraph, land mines, searchlights, &c., this operation taking something like 150 men to do quickly and expeditiously? Surely not engineers and stokers, who should keep fires banked or steam up for 10 knots, say?

3. When on a voyage from place to place, or cruising, chasing, &c., in the tropics, who can keep in working order and maintain such as the light circuits, telephone, telegraph, torpedo and gun circuits, testing of batteries, lightning conductors, the fitting of gun tubes, and many more duties, which the electrical staff can hardly manage now although there are so many of them to do it. How could the engineering staff manage this when already we hear that they have often to work in three watches, and complain of overwork and under pay?

4, and lastly. In action, would it be correct to call up the engineers and stokers to attend and prepare the mines, circuits, search lights, dynamos, switchboards, outrigger boats and boom charges, &c. Surely this state of affairs would warrant the chief or fleet engineer to man the bridge and ask the admiral and his juniors to retire to the engine room and "*stoke up*" for full speed. Surely, from these few illustrations, the results are obvious, and it may interest "R. T. I. C." that these matters have been well considered before its adoption, and that his endeavours must be to encourage the engineer to stand firm to his calling, remembering that as much glory comes to him below as to those above if he stand firm to his guns (I mean engines).

With reference to some questions that "R. T. I. C." wishes answered, I would like to point out that the motto of the Navy is, that "*silence is golden*," and I fully believe in it; not so much that they do not wish our nation to know, but because they specially wish to keep it from other nations, and, with this in view, I shall only answer very briefly and cautiously.

"R. T. I. C.'s" opinion of the abilities of a torpedo lieutenant are very poor; in fact, I ought to say, "*insulting*." I should like to see "R. T. I. C." in command of a few hundred men laying cables, &c., in a mountainous sea, and the dirtiest of weather, small boats, and perhaps under gun fire, this being vastly different to installations in country mansions or central stations.

With reference to the remarks on the joints adopted, and the carelessness apparent, I can only say that "R. T. I. C." does not appear to know of any other joint, nor does he know the use, or reason for same, yet should this joint happen to be the cause of a great victory in time of war, he would wonder at his attitude towards it now.

But even this joint requires art to make properly, and far surpasses the joints made by wiremen and passed by electrical engineers on shore.

Re instruments used, "R. T. I. C." must look up some more information on warships and war, and he may then discover the special advantages of the instruments used in preference to those suggested by him. Although, for the work he suggests, I agree that the Evershed is excellent, but nothing else.

His comparison of the P. and O. service is very weak, for the one is designed for every comfort and luxury, while the other is designed especially for war in as little compass as possible, and as for engaging electricians, it is absurd when there are already nearly two-thirds electricians.

With reference to his quotation about the switchboard fuses and sub-circuits, that, again, shows his want of information upon the subject; but I cannot afford to give him any explanation as it would be at once public, and, no doubt, largely used on shore for similar purposes.

In conclusion, allow me to advise "R. T. I. C." to take a turn himself, or put his sons in the Navy and train them up for electrical engineers, and not to reflect upon the conditions apparent, but rather upon conditions real, when he will find that our first line of defence is really absolutely unique, but *strictly private* to the inquisitive turn of mind. Rest assured that just as the navvy with his pick and shovel can clean or repair a chronometer, so can "R. T. I. C." teach the torpedo lieutenants to do their duty to their Queen and country.

By One Who Has Served.

The Towns' Refuse Problem.

A famous divine once electrified his congregation by giving out as his text the words, "Hang all the law and the prophets."

It is quite true that these words are to be found in the Bible, but the context puts quite a different complexion upon the meaning which these words, unsupported, would naturally convey. The intention of the sermon was to point out how mischievous incomplete quotations may become.

I commend this anecdote to the careful consideration of Messrs. Goodrich and Clegg. The former makes gratuitous assertions, thereby putting words into my mouth, and seeks to support his statements by personal amenities. The latter suggests that my article was a sweeping criticism of destructors generally, and hopes to be able to give me some *facts* later on as to the working at Darwen. The italics are Mr. Clegg's, but I don't think he quite realises what they might imply.

As some misconception may have arisen in the minds of your readers owing to the manner in which portions of my article have been quoted, I may just say that my article was designed to counteract the mischievous effects of the extravagant claims made by interested parties for the value and reliability of refuse as a fuel generally, and to bring into prominence the serious nature of the problem of towns' refuse disposal, and urge the burning of all refuse in properly designed incinerators as the only satisfactory solution.

I am a strong advocate of the introduction of refuse destructors in every town and village throughout the kingdom on sanitary grounds, but I take up the position that the destructor should be regarded essentially as a means of rapidly and completely cremating—not merely such portion of the refuse of a town as may possess a good percentage of carbonaceous matter—but *all* refuse; street sweepings, everything as it comes in the cart. The utilisation of the heat of combustion should be a secondary consideration, and, in every sense, made subordinate to the true functions of a refuse destructor.

There is nothing in my article which is inconsistent with such results as appear to be obtained at Darwen; but what I emphatically insist upon is that to refer to such results as being below the average of what may be expected from towns' refuse is, in the highest degree, misleading.

With reference to Mr. Watson's letter, I may take this opportunity of paying my tribute of praise to his untiring energy and zeal in connection with the introduction of refuse destructors. His work, in itself of a difficult nature, has been rendered doubly so by the ill-advised utterances of more or less responsible engineers as to the value and reliability of refuse as a fuel.

Mr. Watson has always taken up an honest and straightforward attitude in this connection, and while he, I think,

differs from me to a slight extent as to the evaporation which might reasonably be expected from towns' refuse in general, I feel quite sure that he will be with me in joining issue with Mr. Goodrich, or with anyone else who may assert that refuse which is capable of evaporating 1·62 lbs. of water per lb. from and at 212° F. is *below* the "average" quality of refuse.

The Writer of the Article.

The "Brighton" System.

With apologies to the Reason Manufacturing Company.

Into one of two adjacent towns on the Italian Riviera that have electric light, was recently introduced the "Brighton" system of charging. It proved an immediate success, but the "tit-bit" of popularity came from the adjoining town. The tale of its success had wandered there, and an old lady, who had the electric light in her house, heard of it; she first pondered, then after minutely examining her light that evening, took the train over next day, quite determined in her mind to obtain the system at all costs.

She came to the office, and this is what she said to the manager: "I live at X, and have the electric light in my house; but I have heard that you have introduced a system for 'Brighton-ing' the light: I should be so grateful if you would start it in my town."

Perhaps Mr. Wright will now invent a patent Booster-Indicator, so as to meet the dear lady's desires.

S. L. F.

Electro-motors.

I am somewhat surprised at the remarks made by Mr. Knight *re* maintenance of electric motors. 1st. He says that his experience has been that cheap motors properly treated run as well and are as easily maintained as more expensive ones.

What does Mr. Knight mean by cheap motors? Does he mean motors jerry-built? By jerry-built I mean motors with no guarantee as regards efficiency or heating, and insulated with paper, tape, or other cheap substitutes for mica. Or does he mean motors built by makers having no great name, and yet quite equal to, and perhaps, I may say, better than some made by makers with a great name, and charging a great price? If the latter, I can quite agree with him. I have been connected with the manufacture of dynamos and motors for 22 years, and I have found motors in different parts of the country, made by small firms with a practical man at the head, doing remarkably well, and others made by established firms with plenty of capital, running shockingly. Mr. Knight goes on to say that he knows a cheap motor doing a varying load, changing suddenly from nothing to full load, and looked after by a skilled man, which has run four years and never cost a penny, except for new brushes, and has never had a file on the commutator.

This I consider no great performance. I can show the writer several motors running on the corporation mains, made by my own people, that have been running electric cranes and hoists for wool for five years, and have not even worn the first pair of brushes out yet, and by the appearance of the brushes they can still run another five years; the owners have no skilled man but an ordinary warehouseman, who cleans and oils the motors perhaps once a month. These motors have a guaranteed efficiency of 85 per cent. at full load, and do not heat above 75° F. above the surrounding air. I look upon a motor as a machine that must not require any skilled man's attention. It must be such that when kept clean and oiled it is capable of doing its work well and economically. As regards its economy of consumption, when running off the mains of the Corporation at 1d. per unit, it can only just hold its own against the gas engine running constantly and with an equal amount of work, but the total advantage gained is the following:—

Start immediately, no waiting, can be overloaded even up to 50 per cent. for a short time without injury, occupy quarter the floor space or even be fixed on wall or ceiling, require only one pint of oil per week, less cost for insurance and perfectly steady running.

I notice Mr. Knight says the brushes must be kept trimmed and carefully adjusted. This I consider is the maker's work and not the buyer's, and when once fixed and bedded the brushes should never be removed until worn out, thus requiring no trimming, they having a radial feed for taking up the wear. To sum up, I take it that Mr. Knight is taking up his stand for skilled men, or motors with a great name—hence a great price.

I do not agree with him in either of the above, because I know that motors properly made, both mechanically and electrically, with guaranteed heating and efficiency, can be purchased very reasonably (without going to the more expensive makers), and then work without any skilled man near them; in fact, better without the interference, the only attention required being cleaning, say, once a week, which could easily be done in 10 minutes, and the oil run out of the well and fresh put in.

The motor can then be started in 30 seconds by an ordinary child by just throwing over the lever in the case of a liquid starter, or by traversing a lever over some eight or 10 studs in a dry starter, and I may say my people have fixed and connected to the Bradford mains some 28 motors without any skilled men attending them, and have never heard one single individual say he wished he had his gas engine back again, but on the contrary, wished he had tried them sooner. The greatest difficulty we have is getting them to believe our statement. In fact, to overcome this difficulty we consented to instal any one free of charge in order to test its superiority over gas, water, or steam.

In conclusion, I should like to say that I agree with Mr. Prussman, that there is not a really good motor starter on the market.

And motors frequently get blamed for the failings of the starter. We find nothing better for starting motors in the top floors from any floor beneath than the wet starter, but this has the drawback of requiring attention at least once a fortnight; but for starting one in the same room—the wire resistance is better. Perhaps the reader might say why don't we try to improve them if we know what is wanted, but we leave that part to makers who do nothing else, our speciality being the production of the ideal motor.

I trust the above remarks will be of advantage to some of your readers.

A. J. Harris.

Boro Mills, Bradford.
July 9th, 1900.

LEGAL.

The Corporation of Hyde *v.* Oldham, Ashton, and Hyde Electric Tramway Company.

In the Court of Appeal composed of Lord Justices Smith, Williams, and Romer, the case of the Corporation of Hyde *v.* the Oldham, Ashton, and Hyde Electric Tramway Company, the British Electric Traction Company, the British Thomson-Houston Company, and the British Insulated Wire Company, came on for hearing on Wednesday and Thursday last week. It was an appeal from the decision of Mr. Justice Grantham. Plaintiffs claimed an injunction restraining the defendants from breaking open the footways in certain main thoroughfares of the Borough of Hyde and laying electric cables thereunder for the purpose of working tramways which the defendants had constructed. The learned Judge granted the injunction, and awarded plaintiffs £100 damages. Against this the defendants now appeal.

Mr. Cripps, Q.C., and Mr. B. Dennis appeared for the appellants, and Mr. Macmorran, Q.C., and Mr. Sutton for the respondents.

Mr. Cripps stated that under the Tramways Orders Confirmation Act of 1896, Oldham, Ashton-under-Lyne, and Hyde District, the British Electric Traction Company were authorised to construct the tramways in question. The Oldham, Ashton and Hyde Company were their successors. The other defendants were the contractors employed to do the work. The plan for the construction of the tramways authorised by the Board of Trade, under Section 24 of the Act of 1896, involved the laying down of cables or feeders under the footways of the streets traversed. Disconnecting stations were authorised to be erected on the kerbs and the pavement at intervals of between ¼ and ½ mile by means of which the electric current might be disconnected from any section of the overhead wire. In July, 1898, the plaintiffs received notice from the defendants of their intention to open up the ground of the streets along which the tramway was to pass for the purpose of laying the electric supply mains, &c. The defendants had undertaken to pay

£500 towards the cost of widening certain streets. Plaintiffs, however, declined to allow feeders to be laid under the footway unless defendants agreed to pay a further £500 towards widening the streets. The defendants declined to pay any more, and claimed to be entitled to lay feeders under the footways without the plaintiffs' consent by virtue of Sections 3 and 26 of the Tramways Act, 1870.

Lord Justice Smith: I understand that the Corporation of Hyde say "you can only put the wires under the roadway." You say you can put them under the roadway plus the footway.

Mr. Cripps: Yes. The Corporation of Hyde said, "We don't want to raise any question about that if you pay us another £500." My contention is that the defendants have a right to do it. I also say that if we did it wrongfully the plaintiffs are not entitled to an injunction, and that there ought to be no damages. Those are the two points I have to argue. Proceeding to argue these points, the learned counsel said that the term "road," it was contended in the Court below, was not limited to the carriage way. What the defendants did was to put certain pillars or posts which were necessary to carry out the obligation of working the tramway imposed by the Board of Trade on the footway. That the defendants were entitled to do. The defendants had to connect their wires with those posts, which was an essential part of their system. Therefore to a certain extent they had undoubtedly to carry their wires under the footway, as otherwise they could not have connected them with the posts.

Lord Justice Williams: It seems to me by necessary implication here, you have to construct "overhead" as being "underground."

Mr. Cripps replied that it had to be done in connection with the overhead system. There was no contest on that point; that in order to have an overhead system you had to have underground feeders.

Lord Justice Romer agreed, but did not see why the feeders should not be placed under the roadway.

Mr. Macmorran interposed that the posts were on the kerbs, and to that the plaintiffs did not object. But they did object to the wires remaining under the footpath, as it was constantly necessary for the defendants to take up the footway for the purpose of repairing them. That involved a continual disturbance. The plaintiffs did not object to the wires being under the roadway, but urged that there was no reason why there should be underground wires under the footway at all.

Mr. Cripps: What is really the case here is, that the Board of Trade have made these underground feeders an essential part of the defendants' system of electric tramway.

Lord Justice Smith pointed out that that was not necessarily under the footpath.

Mr. Cripps replied that you must go under the footway to some extent in order to get at the posts. His friend's case was, that the defendants must show that they had power to do it. His submission was that, having regard to the requirements of the Board of Trade, and the fact that the posts with which the underground feeders must be connected being on the footway, the defendants could not avoid laying down these feeders for the overhead electric wire system in connection with the electric tramway traction. The learned counsel proceeded to deal with the statutes and the cases bearing on the subject. The House of Lords, counsel reminded the Court, had affirmed the principle that the subsoil was not vested in the local authority. They had no interest beyond that of the surface or artificial pavement. The subsoil was not a portion of the Corporation property. In this case the plaintiffs were not therefore entitled to a mandatory injunction. Defendants were entitled to continue where they were. They were not trespassers as the soil was not the plaintiffs. They had equally as much right to put their feeders there as the plaintiffs had to put gas pipes there. If anyone objected it must be the owner of the subsoil. There was no suggestion that the defendants were interfering with any rights of the plaintiffs.

Mr. Bartley Dennis continued the argument. He submitted that if the injunction were granted it would be to the injury of the plaintiffs. Admitting that the defendants were wrong and had to alter the system and put up overhead wires, that would be an eyesore to the public and an injury to the plaintiffs. Were the plaintiffs and the public to be injured simply because the former might have a bare legal right?

Lord Justice Smith observed that it was for the plaintiffs to judge of that. It was a novel point to suggest that the Court should not grant an injunction, to which the plaintiffs were entitled, because they were so blind that they could not see it was to their injury.

Mr. Dennis said it was for the Court to consider what the effect would be of granting an injunction. He submitted in any case that the circumstances here were not such as to warrant an injunction being granted.

Without calling on the other side, their Lordships gave judgment.

Lord Justice Smith said this was an action by the Corporation of Hyde, who stated that they were the surveyors of highways in that borough, against the Hyde Electric Tramway Company for having broken up the footpath in their borough, and laid what he would call electric feeders underneath the footpath. Plaintiffs also stated that the defendants did this in spite of the protest of the plaintiff Corporation. That was proved. Defendants, however, claimed the right to keep and continue the electrical wires under the footways. They justified their acts under a provisional order and under the Tramways Act of 1870. The real point in the dispute was this:—Could the Tramway Company justify breaking up the footway and putting in an electric feeder along the footway under the Tramways Act of 1870 and the Order in Council? His brother Grantham had found they could not. He was of opinion that the learned Judge was right in his finding. It was now conceded that the Tramways Act of 1870 did not apply to this case at all. The Tramways Act only applied to laying down tramways, and justified laying down tramlines in roadways. He could not see that it had any application to laying down electric feeders under the footpath. Then they came to the Order in Council. The defendants justified their conduct under that Order. One paragraph in that Order in particular was relied upon by the defendants as giving them power to lay electric feeders or cables along and underneath the footways of the borough. Did it? The paragraph stated that under the provisions of this Order the promoters, which in this case was the Electric Tramway Company, might place and maintain on any street or road in which any of the tramways might be laid such posts and overhead wires as might be necessary for working such tramways. What was the meaning there? Was that authority to lay down a cable or electric feeder underneath the soil, or was it power to lay down something overhead and above the soil? He could not read it as meaning anything other than that such posts and overhead electric wires. Mr. Cripps had argued that in order to do this it was necessary to lay wires underneath, although Section 20 only gave justification for laying down such posts or electric overhead wires. Because the company found it necessary to lay these underground wires, you were to read overhead wires into laying underneath wires. He had never heard such a way of construing an order in council. He could not read any justification for it in the order, or in the Tramways Act of 1870, to justify the electric tramway company for doing what they had done against the will of the plaintiffs. The plaintiffs brought an action, and what happened? Plaintiffs proved they were surveyors of highways, and the defendant company had been pulling up their footpaths and doing damage. The learned judge awarded £100 damages. He did not hear of any complaint against what he would call, in legal phrase, the damages for the "trespass" the defendants had committed. But the plaintiffs said they wanted something more. They said that the defendants threatened to do, and insisted on doing, what they had done before, namely, to lay wires underneath the footpath. The Corporation wanted that to be stopped. Accordingly, Mr. Justice Grantham granted an injunction. Mr. Cripps, for the electric company, contended that the learned judge could not grant an injunction, because the work was completed, and it was too late. But this was not a case in which the Corporation had stood by and done nothing, and allowed the company to go on and execute their work at expense to themselves. This was a case in which the evidence showed that in spite of the objection of the Corporation of Hyde, the company went on and persisted in laying down the cable under the footway. It was not too late for the Corporation to ask for an injunction. Mr. Dennis had said the injunction would do more harm than good, and that the public authority ought to know that. If the plaintiffs knew what was good for them, they would not ask for it. That was a novel view. But why were not the plaintiffs entitled to have the defendants stopped? He thought they were. Mr. Justice Grantham's decision was right, and his judgment must be affirmed.

Lord Justices Williams and Romer agreed, and the appeal was dismissed with costs.

Joseph *v.* Williamson & Joseph, Limited.

In the Chancery Division of the High Court of Justice on Saturday, this case came before Mr. Justice Cozens-Hardy as a short cause on motion for judgment. Counsel said that it was a debenture holder's action, and the plaintiff was the holder of second mortgage debentures suing on behalf of herself and other debenture holders of the same issue. The second defendants were the Law and Trust Guarantee and Trust Society, the trustees of a trust deed for securing the first mortgage debentures. The company were electrical engineers of Canonbury. Minutes had been agreed to by all the parties in the usual form, taking a declaration of charge and the usual inquiries. The company was being wound up under a supervision order of the Court. Mr. Justice Cozens-Hardy made the order as asked.

River Plate Electric Light and Traction Company, Limited.

In the Chancery Division of the High Court of Justice on Tuesday, July 10th, Mr. Justice Cozens-Hardy allowed the petition of Glyn, Mills, Currie & Co. for the winding up of this company to stand over until next sittings. Counsel stated that a gentleman was arriving at Buenos Ayres who had been sent out to investigate affairs. This gentleman's report was expected to be received in September, and the petitioners thought that was the only way they had of being paid.

PARLIAMENTARY COMMITTEES.

Shannon Water and Power Bill.

A Select Committee of the House of Commons, presided over by Sir F. Godson, on Tuesday last week, commenced consideration of the Shannon Water and Power Bill. The preamble stated that it was a proposal to supply within an area of 30 miles, and the company should be authorised to enter into agreements with the local authorities for the supply of energy. The capital of the company should be £300,000, divided into 15,000 preferred shares of £10 each, and 15,000 deferred shares of £10 each. The preference shares would bear interest of 6 per cent. It was proposed to construct an aqueduct conduit commencing in the townland of Drummeen, parish of Kiltenanlea, at a port in the west bank of the River Shannon, terminating near Cloonlara. Mr.

Burke, Q.C., Mr. Blennehasset, Q.C., Mr. O'Connor, Q.C., Mr. J. W. Greig, and Mr. Pierce Mahony appeared for the promoters, and there was opposition by the Corporation of Limerick and persons interested in fisheries.

Mr. Burke, Q.C., said that owing to the declaration that had been been laid down by Sir James Kitson's Committee, he was relieved of a great deal of responsibility, and he would be relieved of the necessity of calling expert evidence. Sir James Kitson had said that the value of electrical energy as a means of transmission and the application of power had been amply demonstrated, and its importance to the industries of the country was admitted, and the Committee were accordingly advised that it was to the public advantage to facilitate measures which might ensure a general supply of electrical power to all consumers who might seek to avail themselves of it. At first there was opposition to the scheme by the Board of Works, who thought they might be injured by water being taken away, but they had come to an agreement with the Board of Works, and had agreed to take no water until there were 90,000 cubic feet of water going down the river past their intake. In case the river should go down below that—which was very improbable—they had arranged to have a small auxiliary steam apparatus for the production of the electricity, so that their customers should not be disappointed. This was a scheme brought forward by private persons at their own risk, and the local authorities in the district were enthusiastically in favour of it. The only remaining petition against the Bill were the Corporation of Limerick and those interested in the fisheries. Limerick Corporation had certain works at Castleconnell Lock for supplying the city with water, but there would be no interference with that, because the Corporation only wanted 10,000 feet of water per minute, and if 90,000 feet had to be left, they could not be harmed. The Limerick Corporation were also the gas authority, and had the powers for supplying electric light to the city, and he thought it would be found that they rather viewed the proposal with favour, because although they naturally wanted to conserve the rights they had as regarded electric lighting, yet they did not see their way to generate electricity themselves, and rather looked forward to the company as the wholesale dealer to bring electricity in bulk to them. The only other opposition was that of those interested in the fishing, and he contended that no harm could be done to the spawning.

Mr. Taylor (for the Limerick Corporation) said the Corporation did view the scheme with great friendliness, for he was not without hope that it would be unnecessary for him to trouble the Committee, as clauses for their protection were under consideration.

Mr. Frazer, the engineer to the scheme, was called, and said all the work required was the construction of a canal, which would have a drop of 40 feet. The great power station would be at Cloonlara. They would simply take the water from one part of the river and return it to another. They would carry the electric energy to Limerick and to other towns in the district, who were most anxious to get both light and power. Gas at present was costing 6s. 6d. per 1,000 feet, and if they had power they would use it for many of the industries in the locality. They would supply within a radius of 30 miles of the station. The Bill was exactly the same as the Bill which had been passed by Sir James Kitson's Committee. There were many creameries in the district to whom it would be a great advantage to have the power. Electrical tramways were also to be provided for Limerick, and they could count on them as customers, for in 1887 a syndicate spent £80,000 in inquiring into the question, and that was how the scheme came to be promoted. It could, however, hardly be called a new scheme, because, as far back as 1847, Sir R. King said that as they had no coal they ought to utilise the water-power. When the works were once completed the cost of working would be far smaller than by steam. The total cost of the works would be £300,000, and they had borrowing powers of £150,000.

Further evidence having been called for the promoters, Mr. Balfour Browne wished to oppose the Bill generally on behalf of the Conservators of the Fisheries.

The Chairman intimated that counsel must confine his opposition to certain parts of the Bill, and thereupon counsel withdrew, and the Committee passed the preamble of the Bill.

South Wales Power Bill.

On Wednesday last week the Committee sat to consider clauses, under the chairmanship of Sir J. Kitson.

Mr. Pember asked at the commencement of the proceedings whether he was to address himself on the pronouncement of the chairman yesterday, or on the Board of Trade clause which had been drawn up?

The Chairman said he had better direct his words to the Board of Trade clause. It was admitted that the clause would require some alteration, and the Committee were prepared to discuss the tinkering, or whatever they might call it.

The Board of Trade clause referred to was as follows:—

[Clause.]

The powers of the company for the supply of electricity under this Act shall be subject to the following provisions:—

"1. Electricity shall be supplied under this Act only for use for the purpose of providing power and for the lighting by any person to whom it is so supplied for power of any premises in any part of which the power is utilised and of any houses usually occupied by persons employed on those premises;

"2. Electricity shall not be supplied under this Act by the company in any area being at the passing of this Act the area of supply of any authorised distributors except with the consent of those distributors but that consent shall not be unreasonably withheld. If any question arises whether that consent is unreasonably withheld or not that question shall be determined by the Board of Trade. The consent shall be deemed to be unreasonably withheld if the authorised distributors are not willing and in a position to give the requisite supply upon reasonable terms and within a reasonable time and in considering what are reasonable terms and what is a reasonable time the Board of Trade shall have regard to the terms upon which and the time within which the company are willing and in a position to give the supply.

"3. If at any time after the passing of this Act any local authority or company become authorised distributors in any area within the area of supply under this Act those distributors shall subject to any provision to the contrary in the Act or provisional order under which they become so authorised have the option to take over any supply then given by the company for use exclusively within the area of supply of the distributors upon the terms and subject to the conditions provided in the Act or order.

"In this section the expression 'authorised distributors' means any local authority company body or person authorised by Act of Parliament or provisional order confirmed by Parliament to supply electricity within the area of supply."

Mr. Pember said the first sub-section made it perfectly clear that the company should have the power to supply to any person, company, or body, but if the clause stood as it was, there would be an imminent danger of a state of things arising under which he was afraid his Bill would be rendered useless. A good deal of his electricity could be supplied, whether for power or light, by wayleaves over private property, to either those connected with the measure, or to other persons desirous of taking energy. If the Committee absolutely meant that they were not to have that, all he could say was that it was infringing private rights to a very considerable extent indeed. He knew no reason why if he could supply a great number of consumers whom he proposed to supply with power, he should not be allowed to do it, if the ordinary common law of the kingdom enabled him to do so, when he had once got powers for generating a supply. If the Committee meant that they were to be prohibited from doing that, he was afraid they would make his measure useless. If the Committee did not mean that, then he must have some words in the first sub-clause to make it clear. With regard to the second sub-section and the question of consent being withheld, what now happened in a case like that was that Colonel Somebody or Major So-and-so came down and held an inquiry and reported to the Board of Trade. If there was a proper arbitration, they got Sir Frederick Bramwell or someone else who knew what he was about to hold an inquiry. He thought an arbitration appointed by the Board of Trade would give a quicker and a better tribunal. Further, if his point on the first sub-clause was conceded, words would have to be inserted defining authorised distributors. Passing from that he came to the serious point that authorised distributors was expressly made to include a company so that they might read the clause, "Electricity shall not be supplied under this Act by the company in any area if at the passing of this Act it is supplied by a company except with the consent of that company." That seemed to him to be an extremely strong thing, because it was a distinct declaration by Parliament that they should not supply electricity in any area occupied by a company, and it seemed to him to go so far as to revoke the words in the general Acts of 1882 and 1888, which said that the granting of a provisional order to a company should in no way be a bar to the granting of another provisional order to any other company or person. That was a distinct alteration of the general law affecting electric lighting companies in favour of monopoly, and against competition. Then he would ask the Committee to see how far Sub-Section 3 went. A local authority under the general Electric Act had only the power of purchase at the end of 42 years, but this clause would give the authority as soon as they became authorised distributors power to purchase the company's undertaking when they liked. If the local authority though it worth their while to purchase them at once, they could do so as soon as they liked. In short, as soon as the local authority saw that the company was supplying at a profit they could apply for a provisional order, and having obtained it, would be able to buy that part of the company's undertaking within their district. Of course, he could oppose the grant of the order, but he would have to try and persuade a Committee of Parliament that there was something in his case which warranted them in going against the presumption of law. That was bad with respect to local authorities, but it was worse with a company. He might be supplying, and another company might come in and apply for a provisional order, and under the Electric Light Acts the provisional order which he already held could be no bar against any other; and another company could not only come in, but they would have the option of taking over any supply being given by his company. He said that whatever they might do with regard to the local authority, the company should come out altogether. Upon the decision of the Committee on those points depended really whether the promoters could ever work. He would point out, further, that Clause 36*a* of the promoters Bill should be allowed to stand, viz., "Nothing shall restrict the company from carrying its pipes, mains and wires through the district of any local authority by such road as such authority shall reasonably approve for the purpose of supplying customers outside the district of such local authority." He understood that at an early stage of the proceedings the Committee announced that they did not intend to do anything to prevent the company's mains being carried through districts not taking a supply. There should also be a fourth sub-section to the clause to the effect that nothing therein contained should prevent the company applying for a provisional order for localities under the general Acts.

Mr. Fitzgerald, for the Rhondda District Council, contended that Mr. Pember's speech really reopened the whole case, for he

simply asked them to alter the clause to carry out the original views of the promoters.

Mr. WEDDERBURN, who represented several local authorities, said that the effect of the clause would be to give the promoters power to supply domestic light to colliery villages.

Mr. LLOYD WILLIAMS, for Newport, Cardiff, Swansea, and Barry local authorities, thought a clear distinction should be made between lighting and power. If the clause passed as it stood a person if he took ½-H.P. for power could also take the energy for lighting. The Corporation viewed the common law right to supply by wayleaves with great apprehension.

The Committee having considered for nearly two hours in private, the Chairman announced that the Committee had decided upon the following clause:—

"The powers of the company for the supply of electricity under this Act shall be subject to the following provisions:—

"1. Electricity shall be supplied under this Act only (*a*) for supply in bulk to authorised distributors, and (*b*) for the purpose of providing power and for the lighting by any person to whom it is so supplied for power on any premises in any part of which the power is utilised.

"2. Electricity shall not be supplied under this Act by the company in any area being at the passing of this Act the area of supply of any authorised distributors except with the consent of those distributors, but that consent shall not be unreasonably withheld. If any question arises whether that consent is unreasonably withheld or not, that question shall be determined by the Board of Trade. The consent shall be deemed to be unreasonably withheld if the authorised distributors are not willing and in a position to give the requisite supply upon reasonable terms and within a reasonable time, and in considering what are reasonable terms and what is a reasonable time, the Board of Trade, amongst other things, shall have regard to the terms upon which and the time within which the company are willing and in a position to give the supply.

"3. If at any time after the passing of this Act any local authority or company become authorised distributors in any area within the area of supply under this Act the company shall be subject to any provisions which may be made by the Act or provisional order under which the distributors become authorised as to the taking over of any supply then given by the company for use exclusively within the area of supply of the distributors.

"4. Nothing herein contained shall prevent the company from applying for provisional orders under the Electric Lighting Acts of 1882 and 1888.

"5. Nothing in this section shall authorise the company to supply electricity for lighting other than for the lighting specially mentioned in this section."

Mr. WEDDERBURN wished to know if they could discuss that clause, but the CHAIRMAN said that that was the Committee's decision which they should abide by.

The Committee then adjourned.

On Thursday last week Sir James Kitson's Committee further considered the clauses of the South Wales Bill, but various matters arising in discussion, practically all the Bills in the group were before the Committee

Mr. LLOYD, representing the local authority of Barry, asked that the Board of Trade Clause, which was adopted on Wednesday, might be amended so as to provide that a company should not lay distributing mains in any area which at the passing of the Act was the area of supply of any authorised distributors except with the consent of these distributors. The local authority objected to the power given under the clause to the company to break up streets and lay distributing mains.

The CHAIRMAN said the Committee had decided not to amend the clause.

Mr. LLOYD thereupon said his clients regarded this as a question of principle, and after the decision of the Committee, would take no further part in the proceedings.

Mr. FITZGERALD (for Rhondda local authority) raised the question whether three or seven years was a reasonable time within which the company should give a supply, and also whether 10 or 20 per cent. on the outlay was a reasonable expenditure.

The CHAIRMAN said a clause to be further considered by the Committee would be inserted on those points.

Mr. FITZGERALD next raised the question of dividend, and he explained that by the South Wales Bill a dividend of 10 per cent. with a sliding scale was provided for. His proposal was that, whenever during any year the price actually charged by the company for energy should have been on the average of the year above the standard price, the dividend should, in respect of each $\frac{1}{20}$th of a penny per unit by which the actual average price should have risen above the standard price, be reduced by 5s. for every £100 of paid-up capital.

The CHAIRMAN said that counsel need not argue the question, because the decision of the Committee was that a maximum dividend payable should be limited to 8 per cent. accumulative without a sliding scale. There would be a clause embodying this decision and giving the Board of Trade power of revision at the end of 10 years. If the fuller knowledge and experience gained then justified the change, the Board of Trade would have power to sanction a sliding scale if it were found necessary.

Mr. RAM, Q.C. (for the promoters of the South Wales Bill) reminded the Committee that they had not been heard on this point, but if it was the final decision of the Committee he would have to accept it.

Mr. WEDDERBURN argued in favour of uniformity with the Lancashire Bill, but the CHAIRMAN said it was the desire of the Committee to give every advantage to the small consumer.

The Committee then passed to the consideration of the County of Durham Bill clauses, and

Mr. BALFOUR BROWNE, Q.C., asked for a modification of one of the clauses with reference to supplying where companies existed. He pointed out that the Durham Bill differed essentially from the South Wales Bill, inasmuch as the South Wales Bill took power to supply all over the district, whereas the Durham Bill did not seek to supply the private consumer. What they asked for was that where they could supply cheaper than other companies they should be allowed to do so.

The point was reserved.

Mr. BALFOUR BROWNE, Q.C., for the Durham Bill, said the decision of the Committee with regard to the sliding scale had only just been conveyed to his clients, and they felt that with such a limitation of dividend they would have to seriously consider whether the Bill was of any value to them at all. That was a new venture, for the public would not subscribe the large sum necessary unless they had the chance of a good return.

Mr. RAM, Q.C., said he had not clearly comprehended the fact that the Committee proposed to abolish the sliding scale, but that scale was absolutely vital to the South Wales Bill, and without it there would be no possibility of getting the necessary capital.

Mr. SHAW, for the Lancashire Bill, pointed out that in their case none of the opponents had raised the least objection to the retention of the sliding scale. No question of maximum dividend or a sliding scale was ever raised during the inquiry into their Bill.

Having been further addressed by counsel, the Committee considered the matter a considerable time in private, and on the doors being opened

The CHAIRMAN said: The Committee adhere to their decision that the standard dividend should be 8 per cent., but having heard the arguments of counsel they agree that a sliding scale should be adopted, the principle of such sliding scale being 5 per cent. discount for the amounts charged on the rise of the dividend by 1 per cent. The sliding scale of the standard prices charged are to be subject to revision by the Board of Trade in 10 years.

The Committee then adjourned.

On Friday Mr. PEMBER (for the South Wales Bill) raised the question with regard to the Committee's decision the previous day that the standard dividend and the standard price should be subject to the revision of the Board of Trade in 10 years from the passing of the Act. He asked that the clause should be so amended as to provide merely for a revision of standard price, leaving the standard dividend as fixed by the Committee at 8 per cent.

The point was reserved for consideration.

The following clause, drafted by the Board of Trade for the South Wales Bill, was submitted to counsel for discussion referring to the points raised the previous day by Mr. Fitzgerald, viz., "If within one year from the date of the passing of this Act, the company have not substantially commenced their works for the purpose of carrying out their powers under this Act; and if within three years after the date of the passing of this Act the company have not erected a generating station or stations sufficient in the opinion of the Board of Trade, and are not in a position to supply therefrom, the Board of Trade may order that the powers of the company, under this Act, shall cease; and on any such order being made those powers shall cease accordingly."

COUNSEL for all of the three promoting companies stated that they would be perfectly willing to accept the clause if the one year was altered to two years, and the three years to five years.

This point was also reserved.

COUNSEL for the Lancashire Bill addressed the Committee with reference to the striking out of the provision that a certain amount of capital should be raised before the works were commenced, and this the Committee assented to.

Mr. MOON, for the Durham Bill, addressed the Committee on the granting of power to that company with respect to overhead wires for carrying mains. They wanted to get rid of the restriction which the consent of the local authorities would impose upon them. They did not object to being subject to the control of the Board of Trade. The district they would operate in was largely a colliery district, where sinking was liable to take place, and therefore it increased the necessity for overhead wires.

The Committee considered the various points raised in private for nearly two hours, and on the doors being opened the CHAIRMAN said that the standard demanded in the case of the South Wales Bill should not be subject to revision, but that the relation between price and dividend fixed by the Committee on the previous day should stand. With regard to the lesser clause, two years and four years would be substituted for one year and three years. In the South Wales Bill the maximum price would be reduced from 4d. to 3d., in accordance with the offer of the promoters. In the Lancashire Bill the nature of the cable would be left subject to the Board of Trade. The local authorities would not have any powers over the nature of the cable. In the case of Durham, in the districts of urban authorities the local authority would have absolute veto on the question of overhead wires, but rural authorities would only have a qualifying veto.

The Committee again adjourned.

MUNICIPAL TRADING.

THE Joint Committee on Municipal Trading met again on Tuesday last week, the Earl of Crewe presiding.

Sir THOS. HUGHES, J.P., an Alderman of Liverpool, a member of the Liverpool Chamber of Commerce, and a member of the City Council since 1878, said that he had been engaged in commerce all

his life. After 23 years' experience, he had come to the conclusion that many undertakings would be best carried on and promoted by Corporations rather than by private individuals. In the first place, Corporations could obtain their capital at a cheaper rate of interest, they had no dividends to declare, and his experience had been that there were many men who devoted their lives to carry on these undertakings rather than ally themselves with private undertakings.

What are the undertakings that the Corporation of Liverpool manages?—Tramways, electric lighting, water, markets, public baths, workmen's dwellings, and open spaces. Witness then gave a history of the tramway enterprises of Liverpool which dated back to 1860. He said that up to 1897 the traffic had been worked by horse traction, and the service was generally unsatisfactory. Directly the Corporation came into possession they began to reconstruct the lines so as to adopt them to electric haulage. Already 63 miles of line had been constructed out of a total of 114 miles. The tramways were on the overhead trolley system which met with public acceptance, and as the telegraph and telephone wires throughout the city had been laid underground, the appearance of the streets was little or not at all interfered with. The advantage of the municipalisation of the tramways had been a reduction of the fares to about one half an improvement in the earnings and shortening of the hours of the tramway employés (who were also provided with a uniform), and quicker travelling. The facilities offered for more rapid transit were working an immense change for the better in the social condition of the working classes, especially those employed on dock work. They were removing from the squalid dwellings along the line of docks to places further out, and instead of having to spend 10d. or a 1s. on dinner, they were able to travel home every day during the dinner-hour, and thus save money which could be better spent for the benefit of their families. In 1896 (the last year the tramways were under the control of the company) the number of people who travelled was 36,704,379; in 1899 the number had risen to 63,771,450, or nearly double. The old company's receipts in 1896 were £278,446; in 1899 the Corporation receipts were £359,929, although the fares had been reduced, and they looked for greater improvement still when the whole system was completed. At present they had only done about one-half. It paid the Corporation better to take a 1d. fare for a mile and a half or two miles with electric traction than to charge 2d. for the same distance by horse traction. They had been able to pay interest upon the amount paid to the company for the undertaking, and also upon the cost of construction, besides providing the necessary sinking funds, and still in the short period during which the lines had been working there had been a net profit of £27,508. This was transferred to a reserve fund in order to relieve depreciation. The Corporation were debarred by Act of Parliament from appropriating any portion of their profits before the year 1912. Any deficit—which, however, was not anticipated—would have to be provided out of the rates. Speaking generally, the experience of Liverpool was a sufficient justification for placing tramways under municipal control, but no profits should, in his opinion, go to the relief of rates until the concern was on a thoroughly sound basis. Where a local authority got an electric lighting or tramway order they should be called upon to exercise it within a reasonable period or forego it. If the order was merely obtained as a block it should be set aside.

Questioned as to the electric lighting in Liverpool, the WITNESS said that prior to 1896 it was done by a private company, which was incorporated by Act of Parliament, the Act giving the Corporation power to buy out the company within seven years. Before the expiration of that period negotiations were opened with the company for the purchase of their undertaking by the Corporation. The company asked £400,000, which the Corporation, having regard to the risk which the company had undertaken when the business was in an experimental stage, agreed to pay, although the company had expended only £250,000 of capital. It was a voluntary bargain, and all parties were satisfied. In 1896, when the company were paying 6 per cent. to their shareholders, consumers were charged 7½d. per unit for lighting, and 5d. per unit for power. Now the Corporation were charging ordinary consumers 4d. per unit and public buildings 3d. Traders who were large consumers were charged 2d. for power and 1d. per unit for all beyond 3,000 units per quarter. With these reductions the undertaking was still worked at a profit, with great satisfaction to the public. They were able to work the tramways and electric lighting together from one generating station. No part of the profits had yet been allocated to the relief of rates, although there was nothing in the Act to prevent it.

Lord WINDSOR: Do you see any danger in allowing Corporations to transfer profits from their undertakings to the relief of their general rates.

I think that no municipality ought to look to assisting its rates out of undertakings of this sort until they are on a thoroughly sound basis.

Mr. Ald. J. W. SOUTHERN, of Manchester, having given evidence relative to the water and gas supplies of Manchester, which are both in the hands of the municipality, the Committee adjourned.

At the sitting of the Joint Committee on Municipal Trading on Friday, under the chairmanship of Earl Crewe, evidence was given in private by Mr. Bonham Carter, the official referee.

Mr. Alderman SOUTHERN, of Manchester, was afterwards called, and added to the evidence he gave at the sitting on the previous Tuesday. Witness gave details of the tramways in the city, which from the outset had been constructed by and had been the property of the Corporation. The lines had till now been leased to a company, but the lease would expire next year, and it was then the intention of the Corporation to work them by electricity, in respect of which they had obtained the necessary Parliamentary powers. They had also made arrangements for working the tramways of certain urban districts adjacent to the city in connection with the city tramways. The arrangement which had been entered into was that Manchester should work the tramways and pay a rent for the use.

The CHAIRMAN pointed out that objection had been taken in many quarters to these kind of enterprises, inasmuch as it was held that it was speculating with ratepayers' money in enterprises outside their own area.

WITNESS replied that the question of the housing of the working classes came in connection with the question, inasmuch as it was necessary to replace these people who were evicted when large sanitary schemes were carried out. One of the best ways in which this could be done was to build houses for the working classes near to or outside the boundaries where land was cheaper, and then they had to consider how best to transport the people. It was in this connection that the Corporation had considered the tramway question, and the routes adopted had been chosen with a view to giving cheap means of transit to the working classes—in fact, in some districts they ran tramways where it would not pay a company to. With regard to the suggestion which had been made that there might be a joint board where the tramways went into outside districts, it would be unworkable in Manchester.

WITNESS proceeded to give evidence with respect to the markets and the Manchester Ship Canal, and, continuing, said that in 1890 the Corporation obtained power to supply electricity within the central portion of the city, and in 1896 the power was extended to embrace the whole of the city. The year 1893 witnessed the completion of the works, and the Corporation had supplied continuously since. Altogether the expenditure on land and works had been £641,821. The mortgage debt amounted to £556,278, and that which had been redeemed by the operation of the sinking fund amounted to £49,232. In the year 1899-1900 the income was £86,297 18s. 4d., and the expenditure £49,905 11s. 6d. The gross profits were £36,292 6s. 10d., equal to 6·41 per cent. on the invested capital. In 1894 the number of consumers was 412, while in 1900 they were 3,249. In 1893 the price charged was 8d. per unit, or 2d. per unit or £12 per unit of demand per annum. In 1890 these prices had been reduced to 5d. per unit, or 1½d. per unit and £7 per unit on demand per annum. In 1898-9 the amount paid to the city fund in aid of rates was £12,000. The Corporation had been authorised by Parliament to extend their operations into neighbouring districts, and in pursuance of that power had already arranged with several urban districts adjacent to Manchester. With regard to the supply of electric current for power purposes, he would like to remark that while it was the general belief that such power was only sought by large manufacturers, they had found that it was the small consumer who wanted it. He considered that whenever an enterprise interfered with the streets, it should be in the hands of the local authority, but beyond that all application by municipalites to embark in various undertakings ought to be considered on their individual merits. It would be very difficult to lay down any general rule considering the immense difference there was in different towns.

The Committee adjourned till Tuesday.

Before the Earl of Crewe on Tuesday, July 10th, the Joint Committee of Lords and Commons appointed to inquire into the question of municipal trading resumed their sitting.

Mr. S. CHISHOLM, the Lord Provost of Glasgow, gave evidence as to the various undertakings which were started out of their own revenues and not out of the rates. Those undertakings included water supply, gas, tramways, electric lighting, hydraulic power supply, and telephones, and were carried out not in any sense for trading purposes, but conducted as part of the public establishments of the City for the general good of the inhabitants. The municipality had neither started nor carried on any of these enterprises with the object of making a pecuniary profit to be applied in relief of rates. Practically, they had all paid. The supply of hydraulic power had at first entailed a loss, but this was rapidly being made good. A large reduction had been effected in the price of gas, whilst the acquisition of the tramways had been a great success. The fares had been reduced from 30 to 50 per cent., and half fares introduced, and in two years the number of passengers had been doubled. After paying all working expenses, interest and sinking fund, and providing for depreciation, the Corporation had accumulated out of the revenue, reserve and renewal funds which now amounted to £239,000. It was thought by the Corporation that the enterprises mentioned should be under the control of the public authority, because they were all matters of public necessity in which there could be no competition. He said that since the Glasgow Corporation had taken over the tramways they had reduced the fares from 30 to 50 per cent., had given a better service of cars, and had doubled the number of passengers. They now carried 2,500,000 passengers a week, and he did not think a company would have been as enterprising. The Corporation had obtained permission to establish a system of telephones within an area identical to that of the National Telephone Company, but the question of starting a telephone service would never have arisen had it not been for the grievous dissatisfaction of the National Telephone Company's system. The Corporation employed 8,021 persons altogether, 6,500 of whom were voters.

The CHAIRMAN: Do you think that there is any danger of a combination between your employés, or a combination in conjunction with other workmen to put pressure on candidates for municipal offices?

WITNESS: I do not think there is any real danger of that. Any special advantage which the Corporation employés were seeking

to obtain, would be at the expense of the others, and it would be, I think, a very difficult matter to bring about a dangerous coalition.

Mr. R. SMITH (Sheffield), secretary of the Federation of Ironmongers Associations, considered it a grievance that the Corporation had made serious inroads on the retail trade, and as an instance, stated that the sale of gas stoves by local retailers had been entirely wrecked.

The Committee then adjourned.

PRESTON CORPORATION BILL.

THIS Bill, which has passed a Committee of the House of Lords, was on Monday last before the Police and Sanitary Committee of the House of Commons as an unopposed measure, Lord Edmond Fitzmaurice presiding.

Mr. G. FITZGERALD, on behalf of the promoters, in stating the main objects for which power was sought, said that they included the reconstruction of existing and the construction of additional tramways. In regard to the tramway scheme, the Committee were informed that the part relating to the construction of the tramways outside the borough to Walton and Fulford had been dropped, and the estimate of costs had therefore been reduced from £140,000 to £113,000. The Committee considered and passed the clauses dealing with the tramways.

HASTINGS TRAMWAYS.

BEFORE the House of Lords Committee on Monday last, July 9th, the Earl of Morley presiding, the Hastings Tramways Company's Unopposed Bill came up for consideration. The town clerk of Hastings and Mr. W. M. Bell, the Parliamentary agent, were in attendance, and submitted the necessary proofs of consent on the part of the Hastings Corporation for the proposals contained in the Bill of the Hastings Tramways Company. The Bill was thereupon allowed to pass through its Committee stage in the House of Lords without opposition.

ELECTRIC LIGHTING IN EAST LONDON.

THE Bill to confirm electric lighting provisional orders to the parishes of Limehouse, Mile End Old Town, and St. George's-in-the-East came before Sir F. Godson's House of Commons Committee last week. It was explained that these three parishes, together with Whitechapel, would, under the Local Government Act recently passed, form one municipality. Whitechapel already carried out its own electric undertaking, and the application now was the outcome of a local intention to place the whole of the lighting of the new municipality in the hands of the local authority. The Whitechapel works could be extended sufficiently to allow of this being done. The London and Brush Provincial Company had a provisional order to supply within the area, but had done nothing to carry it out. On the other hand, the Brush Company alleged that they had been prevented from carrying out their order by the opposition of local authorities through whose districts they wished to bring mains from their central stations.

The Committee passed the preamble of the Bill.

BATTERSEA ELECTRIC LIGHTING.

THE Bill confirming the granting of a provisional order for the lighting of Battersea came before Sir F. Godson's House of Commons Committee, and there being no opposition it was ordered to go forward.

SOUTH STAFFORDSHIRE TRAMWAYS.

ON Wednesday last week the Bill enabling the South Staffordshire Tramways Company to sell portions of their tramways to the local authorities, to confirm a lease of their undertaking to the South Staffordshire Tramways (Lessee) Company, to re-arrange capital, &c., came before the Chairman of Ways and Means, and was passed as an unopposed measure.

SOUTHAMPTON TRAMWAYS.

ON Tuesday and Wednesday last week the Duke of Northumberland's Committee of the House of Lords considered the Bill confirming the provisional order to the Southampton Corporation to provide additional tramway facilities within the borough.

Mr. FREEMAN, Q.C., for the Corporation, said by a local Act of 1897 the Corporation was empowered to acquire tramways and was authorised to spend £30,000 on the undertaking. They determined to equip them electrically with the overhead trolley system. It was found, however, that the tramways as they existed were not sufficient for the needs of the town, and consequently they now came to ask for powers to construct a number of additional lines. The construction of these tramways had already commenced, but they could not be worked until the sanction of Parliament was obtained.

Mr. WALLER, adviser to the Corporation both with regard to its electric light undertaking and tramways, gave evidence as to the advisability and the efficiency of the proposed scheme.

The only opposition came from Messrs. Smith, a large firm of drapers in Bridge Street, who alleged that the tramway would prevent carriages coming to their doors and consequently their trade would be injured.

The CHAIRMAN said the Committee would pass the preamble with a proviso that a space of not less than 5 feet 6 inches should be kept between the kerb and the line with regard to that portion of the line which affected Messrs. Smith.

SOUTH-EASTERN METROPOLITAN TRAMWAYS BILL.

THE Bill of the South-Eastern Metropolitan Tramways Company, which sought to authorise that company to convert their existing horse tramways between Greenwich and Catford to electrical tramways was before Lord Rosse's Committee of the House of Lords on Thursday last week. It was stated that the opposition of the London County Council had been withdrawn, and the Bill was accordingly ordered to go before Lord Morley's Committee an unopposed Bill.

Before the House of Lords Committee considering this Bill, under the presidency of Lord Morley on Monday last, the unopposed Bills included the South-Eastern Metropolitan Tramways Company's Bill, which authorises that company to equip a system of tramways from Greenwich to Catford, and to equip them by electrical power, and operate on any system other than the overhead. There had been some opposition offered in the lower House to this Bill, but certain requirements urged by the authorities in order to safeguard their electrical disturbance to the Royal Observatory having been met satisfactorily by the promoters, this opposition was withdrawn, and further, a veto on the system asked for by the L.C.C. was refused. At first the Bill was opposed before the House of Lords, but the L.C.C. having withdrawn their petition, a few amendments were inserted on Monday last, and then the measure was passed unopposed.

CHARING CROSS AND STRAND ELECTRICITY SUPPLY CORPORATION, LIMITED.

ON Friday, before Lord Rosse's Committee of the House of Lords, the Bill of the Charing Cross and Strand Electricity Supply Corporation was considered. The Bill asked for powers to erect a generating station in the parish of West Ham, and to lay the necessary connecting mains for supplying the City.

Mr. PEMBER, Q.C., explained that under the order the company gained last session to light the City of London they were bound to erect a new generating station for the City within two years on a site to be approved by the City Corporation. The Corporation approved of the site, but objection was taken that it was outside the limits of the company's area. Lord Cross's Committee had, however, decided that undertakers of electric light should be permitted to have large generating stations outside their area, with all the accompanying powers of the general legislation for the purpose of taking their mains through intervening districts. The petitioners against the Bill were the local authorities of West Ham, Mile End Old Town, Poplar, and Whitechapel, through whose districts the mains would run, and also the Corporation of London. The ground of objection of the Corporation was that of the proposal to carry mains through the City for the supply of districts beyond the City.

Mr. PATCHELL, engineer to the Corporation, described the station it was proposed to build at West Ham. They would have both railway and water facilities. It was proposed to erect two generating stations—one to supply electricity to the City and the other to supply electricity to their other districts. Those two generating stations were to be made absolutely apart, so that should the City ever elect to purchase, they could purchase their own generating station. It was proposed to erect five sub-stations in the City, and each would require a cable. It was proposed to carry seven cables through the streets, five of which would be for the City, and two would be carried through to the West End. At present, his company had a station at Maiden Lane, Strand, and one at Lambeth, but they were within measurable distance of being filled up. By the time they got the station built at Bow a further supply would be needed for the Western District, and that supply they intended to get from Bow. He would stake his reputation that they would be able to lay down the mains in the proposed route without the slightest difficulty. With regard to the powers asked for in the Bill to supply local authorities, they only asked to be allowed to supply in bulk to the local authorities if they were requested so to do. They did not ask to be allowed to compete. At the end of last month they were supplying 206,090 8-C.P. lamps in their districts.

By Mr. LITTLER, Q.C.: At present the power they had to break up streets in the City was for the supply of the City only.

Mr. LITTLER: What harm would it do you if the power was subject to the consent of the local authority, which, however, should not be unreasonably withheld, and with an appeal to the Board of Trade?

WITNESS said it might do them very much harm, as there might be great delay.

On Monday last the Bill was again considered, and the Committee passed it as unopposed.

SOUTH LANCASHIRE TRAMWAYS.

THE Bill providing for the construction of an extensive scheme of electric tramways for the South Lancashire district, which includes Swinton, Lowton, Earlstown, St. Helens, Brynn, Wigan and Bolton, with Leigh as its generating centre, was before the consideration of a House of Lords Committee last Tuesday, and was presided over by Lord Portman.

Mr. PEMBER, Q.C., stated that the opposition to this Bill had been

withdrawn by the Wigan and District Tramways Company, and an arrangement had been come to whereby the promoters of the Bill should undertake not to go on with the line from Wigan to Ashton, in Makerfield, until such time as would give the Wigan and District Tramways Company the opportunity to decide whether or not they themselves would proceed to Ashton in Makerfield with their light railway. The time allowed for that had been fixed upon as two years.

Mr. P. Thomas, the town clerk of Leigh, gave evidence as showing the important necessity of such a tramway as that proposed, especially on Friday and Saturday nights, which were market nights for Leigh, the centre of the district, when farmers and others came from two to six or seven miles' distance into the market, and had to get back to their villages late at night. He urged that the present mode of conveyance by brakes or omnibuses was often not equal to the demand, and therefore at present they had to tramp along lonely roads and lanes to reach their homes.

Further evidence was given respecting the scheme, which was said to be supported by practically all the local authorities, between 20 and 30 of which are affected, and also by the large population which is to be served.

A petition of the Leeds and Liverpool Canal Company having been heard, the Committee came to the decision that the clause it was proposed to insert into the Bill would sufficiently protect that company if the question of expenditure was dealt with by a short additional provision.

The Bill was then ordered to be read a third time.

REVIEWS.

Electric Ship Lighting: A Handbook on the Practical Fitting and Running of Ships' Electrical Plant. For the use of shipowners and builders, marine electricians, and sea-going engineers-in-charge. By John W. Urquhart, electrician, author of "Electric Light Fittings," &c.

This is one of a series of books, by the same author, designed apparently for the use of those to whom the ordinary technical works would not be of service—those who have not the time or the opportunity to study the subject thoroughly, but who want to pick up sufficient knowledge to enable them to arrange for, and to look after, the apparatus.

The book is in a very handy form for use on board ship. The type is clear—a point by no means unimportant when reading has to be undertaken to the accompaniment of the constant vibration of the ship's engines; the diagrams are also clearly printed.

But the book itself suffers from the same cause that so many technical works do. An edition takes some years in selling out, and meanwhile the practice in that particular branch of engineering moves on, but the exigencies of the difference between sale and cost prices forbid much alteration in the reading matter, and so the latter often has the appearance of the literature of a bygone day.

Unfortunately, it gives the reader who is up to date the impression that the author was not fully cognisant of the subject he was writing on.

In the present work, for instance, most of the information is such as a writer might have given, say, 15 years ago, and is, consequently, terribly misleading at the present day.

The author appears not to have pursued any system in imparting the information he is giving. Though the chapters are arranged so as to divide the subject into convenient sections, such as introductory, shipbuilders' pre-arrangements, engines for ship lighting, dynamos for ditto, management of dynamos, search-light and arc lamps, wiring and fitting, lamps, switches and cut-outs, conductivity and insulation testing, accumulators, typical installation, man-of-war fittings, &c., we find the different parts of the subject treated, in any chapter, apparently as it happens to strike the fancy of the author at the moment.

It appears to us, also, that the author has taken up a lot of space in giving information that is of very little service to those for whom, it may be presumed, the book is mainly intended. Alternating currents, for instance, come in for a good deal of attention; yet the author should know that alternating currents are not now used on board ship. Again, the author devotes considerable space to the matter of accumulators, apparently on the ground that they are occasionally used in yachts. Arc lamps also, with the exception of search-lights and those used for the Suez Canal, surely do not come within the scope of ordinary ship lighting, yet the author has devoted considerable space to their working.

On the other hand, he gives very little description of the apparatus, and very little explanation of the simple underlying principles of the science, that might be a guide to the marine engineer in dealing with the apparatus under his charge.

Unfortunately, much of the information given is very misleading. Thus, on pages 49 to 54 we have a long description of the supposed working of series, shunt, and compound-wound dynamos, which is utterly at variance with what is now known, by every college student, to be the correct explanation. We are gravely told, for instance, that if a shunt-wound dynamo is used to run arc lamps in series, the arrangement is self-regulating at constant speed. And then we are told that with compound-wound dynamos, as lamp after lamp is switched on, the resistance of the leads falls, and that this implies diminished resistance of the series coils of the magnet, and hence regulation.

On the next page we are told that a fast running dynamo is unsuitable at sea, because it performs constantly at high pressure.

Again, on pages 157 and 158, the author discusses the question of using lead-covered cables, and proceeds to state that there is great difficulty in making *good joints in the lead covering*—the italics are ours. And then he goes on to refer to "the electrical difficulty of ensuring that there shall be no contact between any part of the case of any cable and the extension lead sheath. It is plain (he goes on) with reference to the latter, that any contact of this nature *puts the whole of the core to earth*,"—the italics, this time, are the author's. And on the next page he tells us that the lead sheath should be regarded as so much insulation. We are inclined to think that most electricians, even 15 years ago, would have objected to a statement of that kind!

On page 163 is given a plan of the wiring of the principal parts of an Atlantic liner. The diagram is printed very clearly, but, unfortunately, the connections shown are very peculiar.

There appear to be two sets of mains, one set for the starboard service, and one set for the port service, and the author explains that it is the practice to wire all the principal parts of the ship, half on each set of mains. This is very good, and a very proper arrangement; but the diagram shows the state rooms on each side wired from the mains on that side, and the lamps of the saloon, library, and smoke room, wired from both starboard and port mains, but the lamps are apparently arranged in series, and in a most peculiar manner, that can hardly represent the actual arrangement. Of what earthly use can a diagram of that kind be to men who are novices to the work? Would it be of any service to men who were skilled wiremen?

On page 167 the author gravely informs his readers, when dealing with connections to the ships, "that there will be electrolytic action in the presence of salt water," "around an electrical connection composed of *two dissimilar metals* depending on the direction of the current"—the italics are again the author's. The author devotes nearly two pages to explaining that it is practicable to use lamps of different candle-powers on the same circuit, provided they are made to work with the same voltage; he seems hardly sure about it though, after his long argument, and he is careful to assure his readers that lamps made for 50 volts cannot be well used for 100-volt circuits. He seems quite sure of this. A page and a half are devoted to explaining how to use a soldering iron; surely a marine engineer can teach the author anything he wants to know about soldering.

In the chapter on accumulators there are the same misleading statements. If the author considered that it was necessary to deal with this part of the subject, surely he might have taken a little trouble to ensure that his information was correct, or at least intelligible; but what is to be made of the following?

"Most suitable pressure. In cases where accumulators are used, a pressure of some 55 volts appears to be the best. Since the accumulator cell may be taken to be capable of maintaining 2 volts only, 26 cells are required to form the battery required in this instance; 50-volt lamps are supposed to be employed, with a dynamo capable of giving 2·5 volts for every cell to be charged. Thus the dynamo

must yield a pressure of 78 volts, and it must be shunt-wound."

We have left ourselves very little room to notice the chapter in which the author is supposed to have brought the whole thing up to date. It appears that he has been the recipient of many inquiries from naval electricians (?) about the fittings of men-of-war and about arc circuits, and in Chapter XI. he has endeavoured to meet the wishes of his inquirers.

Unfortunately, there is the same looseness of treatment as in the older portion. The author's statements of the fitting up of a man-of-war are very much at variance with those given by Mr. Grove in his recent paper before the Institution of Electrical Engineers, and as Mr. Grove has taken an active part in the work he describes, we may suppose that he is more likely to be correct.

Our author appears again to be singularly hazy in many of his statements. He refers, for instance, to carrying arc lamps of 50,000 C.P. *on* each masthead. He gravely records the fact that water is thrown on board from the sponsons, which he also describes, and proceeds to explain that the water is a nuisance to the deck officers. What has this to do with the subject? Further on he explains that naval brigades are in the habit of taking search-light plant with them, and he describes the plant. According to the description the handy man, among his other qualifications, is able to get 200 per cent. out of the plant entrusted to his keeping. Thus the plant is given as a 10-H.P. engine, and it furnishes easily 80 volts and 200 amperes (p. 282). Would it not be better to be accurate in a book of this kind? Throughout the book there are instances of slips of this kind, and of careless work; of the use of words not often used in general conversation when ordinary language would answer better; and, unfortunately, the words are often misplaced. Thus "interpolar" is used where the author means connecting wire. Solenoid is spelt with an *i* instead of an *e*. Why is this?

BUSINESS NOTES.

Electrical Wares Exported.

Week ending July 11th, 1899.		Week ending July 10th, 1900.	
Alexandria. Teleph. mat.	Value £32	Albany	Value £127
Amsterdam	181	Auckland	81
Barcelona	14	Azores. Teleg. mat.	909
Barranquilla. Teleg. mat.	111	Bombay	178
Bilbao. Teleg. mat.	145	Buenos Ayres. Teleg. mat.	178
Bombay. Teleph. mat.	127	" Teleph. mat.	154
Boston (U.S.A.). Teleg. apparatus	2,796	Calcutta	234
Boulogne	90	Cape Town	396
Buenos Ayres	70	Christiania. Teleg. wire	26
" " Teleg. wire	560	Colombo	12
Calcutta	382	Copenhagen. Teleg. cable	809
Cape Town	176	Durban	495
Christiania	13	East London	216
Copenhagen	17	Flushing	19
Delagoa Bay	13	Gibraltar	40
Demerara	15	Hamburg. Teleg. mat.	1,350
" Teleg. mat.	123	Hiogo	1,466
Durban	383	Malta	66
" Elect. cable	1,432	Melbourne	251
" Teleg. mat.	1,357	" Teleg. cable	408
East London	213	Port Darwin. Teleg. mat.	76
Fremantle	18	Port Elizabeth	329
Gothenburg	22	Rio Janeiro	189
Hamburg. Teleg. mat.	600	Sydney	558
Helsingfors	89	Teneriffe	65
Hobart. Teleg. cable	130	Valparaiso	115
Kertch. Teleg. cable	3,000	Yokohama. Teleph. apparatus	100
Las Palmas	14		
Madras	15		
Mauritius	15		
Melbourne	77		
" Teleg. mat.	555		
New York	12		
Odessa	75		
Ostend	20		
Perth	13		
Port Elizabeth	120		
Rangoon	85		
Rotterdam	103		
" Teleg. mat.	117		
Shanghai	2,188		
Singapore	115		
" Teleg. cable	18,000		
St. Petersburg. Teleg. wire	110		
Stockholm	36		
Sydney	796		
" Teleg. cable	570		
Tientsin	65		
Wellington	191		
Yokohama. Elec. cable	188		
Total	£35,490	Total	£8,800

Foreign Goods Transhipped.

Stockholm. Teleph. mat.	Value £55
Trinidad. Teleph. apparatus	55
Total	£110

Bankruptcy Proceedings.—Notice is given of the release of trustee (Mr. T. H. Kaye) in the case of J. E. Stott, electrician, Huddersfield.

Liquidations. — The Electric Automobile Syndicate, Limited, is winding up voluntarily, with Mr. Albert Brown, 28, Great Eastern Street, E.C., as liquidator.

Creditors of the Midland Electrical and General Engineering Company, Limited, must send particulars of their debts, &c., to Mr. W. B. Winnicott, liquidator, at 20, Fletcher Gate, Nottingham, by August 13th.

A meeting of Mather & Platt, Limited (1892) will be held at Salford Ironworks, Manchester, on August 20th, to receive an account of the winding up from the liquidator (Mr. J. Mather).

Catalogues and Lists.—Messrs. Ross, Limited, manufacturing opticians, of New Bond Street, W., send us a copy of their handy-sized catalogue in which they give illustrated particulars of binoculars, telescopes, opera glasses, drawing instruments, and a variety of optical and photographic apparatus and accessories.

Messrs. T. Ledward & Co. have issued a catalogue of their ejector and evaporative types of condensers for steam engines. Full descriptive matter is given, and it is made the more interesting and instructive by a large number of sectional and other drawings explaining the working. Other specialities of this firm are also included, notably their patent re-cooler. Some tables appear of the expansion of steam in cylinders, engine constants, the properties of saturated steam, strength of cast-iron in pipes, and so on.

The Fairbanks Company, of 16, Great Eastern Street, E.C., and numerous American cities, send us a small brochure in which are illustrated a number of the prominent tall buildings of Manhattan in which Fairbanks' valves are installed. These valves are recommended for use in connection with all systems of steam heating for buildings of this character. A short description of the globe, check and gate valves and iron cocks is given. Copies of the list may be obtained on application.

Messrs. Neville Bros., of Liverpool, send us illustrated leaflets of their armature disc, notching and dividing machine, the Stollberg winding machine for electro-magnetic and induction coils, and the Franco Tosi electric light engines.

Messrs. Mather & Platt, Limited, send us a copy of the third edition of their pocket catalogue of electrical machinery. For neatness and compactness, as well as for the pleasing illustrative effect, we think it is as good as any list of the kind that we have seen. In the space of 120 pages (measuring 5 inches × 3½ inches) a large amount of descriptive and detailed information in tabulated form are given relating to multipolar dynamos for rope and direct driving, combined plants, multipolar motors, balancers, boosters, and motor-generators. Enclosed motors, turbine pumps, water-softening plants, electrically driven cranes, and electric shunting locomotives are all briefly particularised in Part I. of this handy little pocket list. In Part II. are tables of efficiencies, steam consumption, wire tables, tables showing the sag of overhead wires, and other serviceable data of a like kind. Would not a few memoranda sheets be a useful feature to adopt in future editions?

Germany.—The Rheinische Schuckert Gesellschaft für Electrische Industrie of Mannheim reports a profit of £9,973 for last year, and is declaring a dividend of 10 per cent. as against 8 per cent. in 1898.

Installation Work.—Messrs. W. Liley & Co., of Liverpool, send us a list of a number of private installations for electric lighting and motive power which they have lately put into various residences, offices, and other business premises for 230 volts Corporation supply; also two new Wallasey ferry steamers.

Meeting of Creditors.—A meeting of the creditors of William Ramsay & Co., electric engineers, &c., was held on 4th inst. in the Faculty Hall, Glasgow. The statement of affairs submitted showed liabilities £5,695 5s. 9d., and assets £3,839 11s. 1d. Mr. Thomson M'Lintock, chartered accountant, was appointed trustee, and Messrs. Mitchells, Johnston & Co. law agents in the sequestration.

Meldrum Furnaces.—The *Sheffield Telegraph* is now using dust coke as fuel for its two boilers, and has adopted Meldrum's forced draught. This step was taken on account of the high price of coal and because certain tests made by Mr. Bryan Donkin on different kinds of fuel were brought to their notice. The cost of fuel is stated to have been very considerably reduced.

Northampton Institute.—We have received a prospectus of day courses in mechanical, electrical, and horological engineering, which have been arranged for this Institute for the 1900—1901 session. These will form a new departure. They are stated to be an excellent preliminary for the most advanced technical and professional training. They are also intended for students who desire to obtain a good technical training in engineering before being apprenticed in engineering works; for those who, being already engaged in engineering work, are anxious to extend their knowledge of the fundamental principles. Admission examinations are to be held on September 26th and 27th, and the work of the courses will begin on October 1st. Those who are further interested in this matter should obtain a copy of the prospectus from the principal, Dr. R. Mullineux Walmsley.

Outings.—The employés of the Jandus Arc Lamp and Electric Company, Limited, went for their annual outing to Eastbourne on June 30th.

Private Bills.—The Cork Electric Tramways Bill was read a third time, and the Manchester Corporation Tramways Bill a second time, in the House of Commons on Monday.

The Hamilton, Motherwell, and Wishaw Tramways Bill passed third reading on Monday.

The Shannon Water and Electric Power Bill has been read a third time, and the Glasgow District Tramways Bill a second time, in the House of Commons.

Smoke Nuisance.—The South London Electric Supply Corporation has been fined £10 and costs upon each of three summonses brought by the Lambeth Vestry for causing a black smoke nuisance.

Trade Announcements.—So that they may be enabled to cope with increased business, Messrs. J. H. Tucker & Co., electrical fittings manufacturers, have removed to larger works. Their Birmingham address is therefore removed from Oozells Street to Sampson Road North.

Mr. J. W. Barnard, sole agent for the E.P.S. Company, has found it necessary to acquire additional premises at 6, Great Winchester Street, E.C., in order to meet the enhanced demand for E.P.S. small storage batteries. The extended facilities will enable him to keep a large stock ready for immediate delivery.

The General Electric Company, of New York, has opened a London office at 110, Cannon Street, E.C., for the sale of its well-known electrical apparatus and supplies to the colonial and ex-territorial trade. The business of the office will be conducted in closest accord with that of the British Thomson-Houston Company, Limited, and of other companies owning General Electric patents in various countries or licensed thereunder. Inquiries regarding possible business transactions, and those also relating in a general way to the application and operation of electric traction, lighting, power transmission, mining installation, naval and military work, marine outfits, mill equipments, electrolytic machines, &c., will receive every attention. Mr. Wm. J. Clark, as the general manager of the Foreign Department, General Electric Company of New York, U.S.A., is in charge.

A New Arc Lamp.—Messrs. Koerting & Mathiesen manufactured last year a shunt lamp with double open arcs, which we are informed has proved a great success. Figs. 1 and 2 show the construction of the lamps. One of the characteristics of the lamp is that it contains two independent clockworks, which are, however, both built on the same base plate; the regulating parts are of the well known type by which the magnet with a balancing armature works a swinging clockwork, as will be seen by fig. 2, which shows

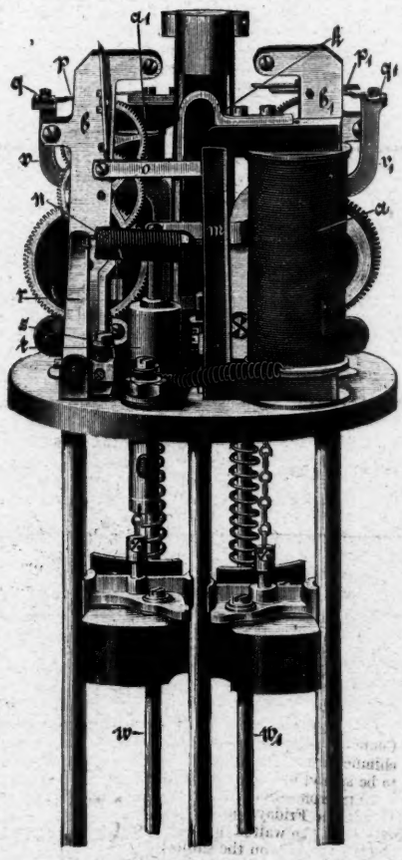


Fig. 2.

fairly clearly the regulating parts of the lamp. This mechanism consists of a shunt wound magnet A and a clockwork B, which is connected by means of the rod O with the magnet armature M. The force opposing the magnet is provided by spiral springs N; the corresponding parts of the second clockwork, as far as they can be seen from the sketch, have the same letters with the suffix 1, for instance, A_1, B_1, &c. The scape-wheel, P, of the clockwork, B, touches the tongue Q, which is carried by a double bent lever V, and this and also the second tongue Q_1, are under the common influence of the heat compensator K, which keeps the regulating tension always constant. The alteration of the weight of the carbons is made good by the clockwork rising on one side, so that the regulating tension is not influenced in that way. The clockworks are so made as to

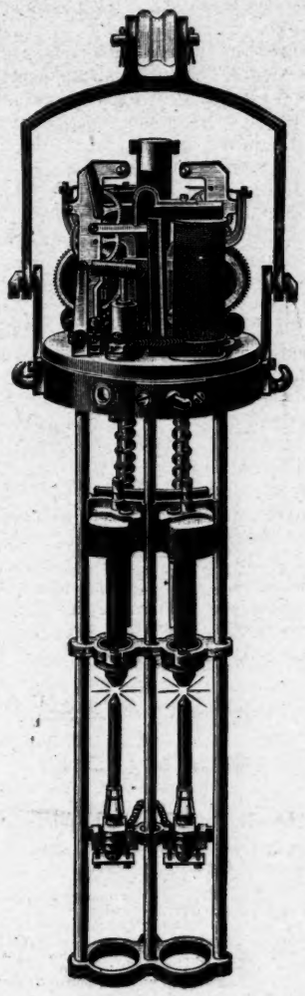


Fig. 1.

counteract sudden movements by air dampers T. The arc tension can be regulated by altering the screw S, by which the spiral spring, N, is more or less tightened. The advantage of this double carbon lamp is that it will burn either singly on 110 volts or in pairs across 220 or 230 volts, the latter for town circuits, &c., being very convenient for a consumer who only wants two lamps instead of four or six, which would be necessary in the single carbon open arc lamps. There is, however, a disadvantage as regards working expenses, because the double carbon lamp has two pairs of carbons burning instead of one, although of course of lesser thickness, but still the cost comes out higher than the single carbon lamp, and the light intensity of the double arc lamp is not so great as with a single carbon lamp of the same energy consumption, although it is claimed to be superior to the enclosed arc.

Trips to the Continent.—Intending visitors to the Continent who wish to take a quiet holiday, avoiding Paris, will find the leading features of a number of places worth seeing attractively mentioned, with sketches, in a small booklet just published by the Great Eastern Railway Company, in which particulars of new tours *via* the Royal Mail, Harwich, Hook of Holland route are to be found.

"Valvoline."—"Valvoline" oils are the lubricants used by all the French and many of the foreign engines at the Paris Exhibition. These oils are manufactured solely by Messrs. Leonard and Ellis of New York, whose representatives here are Messrs. Boult Bros. & Co., of Liverpool.

Yost Typewriters.—The Yost Typewriter Company, Limited, has just executed an immediate delivery order for 156 typewriters for Her Majesty's Government. This is stated to be the largest typewriter order ever given.

ELECTRIC LIGHT AND POWER NOTES.

Aberdeen.—Mr. J. A. Bell, Corporation electrical engineer, has submitted an elaborate report to the Gas and Electric Lighting Committee of the Town Council on the system of charging for electrical energy. The present scale of charges in Aberdeen for lighting is 6d. per unit for one hour's use per day of the maximum demand and 3d. afterwards. For power, the charges are 3d. and 1d. per unit respectively.

Action has been taken against Messrs. P. C. Middleton & Co., whose premises are described as the Cults Electricity Supply Station, for causing a noise at these works so as to cause a nuisance to residents in close proximity thereto. The defendants deny that the operations cause a noise amounting to a nuisance.

Bath.—At a meeting of the Electric Light Committee on Tuesday, the Works Committee reported that they were not able to suggest any alteration that would appreciably diminish the cost of the works, but they recognised that if the four old engines were replaced by new ones, considerable saving in the cost of fuel would be effected. The laying of new mains having made considerable progress, discussion took place as to the best means of increasing the number of private consumers. It was resolved that local wiring contractors be required to have their business premises or private houses wired and connected to the mains; any wiring contractor so connected, who engages a canvasser to be employed for canvassing for electric lighting, to be allowed a commission of 1s. for every 16-c.p. lamp wired according to the Corporation regulations by such contractor, and connected by the authority in private houses during each quarter. A report is to be prepared on a system of hire wiring.

Batley.—The Town Council has resolved to apply to the Local Government Board for sanction to borrow the sum of £22,231 for electrical supply works for lighting and traction.

Beckenham.—At a meeting of the District Council on Monday it was reported that a letter had been received from the Local Government Board, sanctioning a loan of £7,000, repayable in 10 years, for the wiring of houses. Instructions were given to the engineer to prepare a form of specification and tender. A telegram had been received from the British Insulated Wire Company, agreeing to the scheme of free wiring previously brought before the Council. The Council decided that in connection with the loan for free wiring, Mr. Reginald P. Wilson, consulting electrical engineer, be retained to supervise the wiring, at a fee of 2½ per cent. on the amount expended out of the loan during the British Insulated Wire Company's period of control. The Council also instructed the engineer to prepare specifications and invite tenders for the erection of transformer stations.

Bexhill.—Having received Mr. Preece's report on extensions of the generating plant, the Council has resolved to apply to the Local Government Board for sanction to borrow £7,772 for additional machinery, extension of mains, &c.

Bradford.—The Electricity Committee has been inviting tenders for the supply of 8,000 tons of coal for the electricity works for the year commencing August 1st.

Bury.—The annual report for the year ending March 31st last of the Bury electricity works, issued by the electrical engineer, Mr. S. J. Watson, shows that the number of consumers of electricity in the borough is 198, with 14,733 8-c.p. lamps. This represents an increase of 54 consumers and 4,458 lamps during the year. The number of units sold for all purposes during the year was 213,395, as against 115,853 for last year, and 64,462 for the preceding year. Several important extensions have been carried out. There are now 31 arc lamps erected in the main streets of the town, 13 having been set to work during the past year. The total cost for generation and interest and sinking fund during the year was £3,398, and the revenue was £3,582, the profit equalling £184; last year there was a deficit of £336.

Cardiff.—At a meeting of the Electrical and Lighting Committee of the Corporation last week, Mr. H. J. Burstall, the engineer appointed to inspect the 300-kw. Ferranti engine alternator, reported that it was now finished and adjusted to his entire satisfaction, the whole of the work decided to be done under the terms of settlement having been carried out. The engine was ready to be taken over by the Corporation. Mr. Appelbee, the resident engineer, also said the engine worked well and satisfactorily, and could be taken over. The Committee resolved to accept it accordingly.

Chester.—In view of the greatly increased price of gas at Chester Workhouse, it has been suggested at this week's meeting of the Board of Guardians that an engineer should be asked to inspect the house and make a report, as it was conjectured that electricity could be introduced on the premises at less cost than was paid for gas. A committee was appointed to deal with the subject.

Colchester.—The Town Council has appointed Mr. A. R. Sillar, its present electrical engineer, to take charge of the electricity works at a salary of £250 per annum.

Cupar, Fife.—Mr. D. Mackenzie estimates the probable cost of the installation of electric light at the Fife and Kinross Asylum at Springfield at £3,150, and that an annual payment of £350 for 30 years would repay the interest, working expenses, and total cost. At present the board pays about £400 per year for gas to the Cupar Gas Company.

Dalkeith.—A scheme having been adopted by a majority of the Commissioners in favour of the electric lighting of the streets, the three Commissioners in the minority have secured a report from Mr. W. A. Bryson, electrical engineer, Leith, stating that as there were so many narrow streets in the burgh, much of the light from arc lamps would be wasted, and recommending incandescent gas lighting for the purpose. Dalkeith is an old burgh, with streets which extend altogether to about six miles, exclusive of courts and closes.

Dublin.—We gather from the Dublin papers that on Monday night there was a serious breakdown of the electric lighting arrangements. The engineer was preparing a report on the matter for the Electric Lighting Committee, and no explanation was vouchsafed to the newspaper man.

Glasgow.—The Corporation has been inviting tenders for the supply of 10,000 tons of coal, to be delivered in quantities by May 13th, 1901.

Grimsby.—The Local Government Board has sanctioned the loan of £6,000 for electric lighting purposes.

Hanley.—The reports of the borough and electrical engineers, Messrs. Lobley and Cowell, show that the capital expenditure last year was £7,044, bringing the total up to £67,829, equivalent to £55 per kw. The total capacity of the works was 1,224 kw., and the maximum demand was 550 kw. The expenditure on revenue account last year was £7,632, and the receipts £8,809, leaving a gross profit of £1,177; after paying interest and sinking fund, there was a deficit of £2,269.

A sub-committee reported to the Town Council that the losses during the last three years were due to too early reduction of the price of energy, increased cost of fuel, &c., abnormal repairs to plant, and increased capital charges. The Council resolved to raise the prices to 6d. and 3d. for lighting, and to 3d. (four hours) and 1d. per unit for power.

Hastings.—The Town Council on Friday agreed to an extension of the mains, the total cost of which is estimated at £1,232, to be raised by loan. In order to effect a saving in the electric light works it has been decided to discontinue one station, to remove part of the plant to another station, and to dispose of the remainder. There was a small profit on the last year's working.

Ilfracombe.—The District Council has instructed the General Purposes Committee to report upon the advisability of transferring the Council's electric lighting order to a company.

Ingleton.—It having been found that the Town Council's agreement with the Electric Lighting Company is void, the Council has asked the company to desist from lighting the street lamps pending the adoption of the Lighting Act.

Inverness.—The scheme for lighting the burgh with electric light has been abandoned by the Council.

Leamington.—At this week's Council meeting the town clerk stated that, as instructed by the Council, he had written to the Midland Electric Light Company offering £17,000 for their undertaking. In reply the Midland Electric Light Company said that the offer was ridiculous, and could not be entertained. Their undertaking was bound up with the progress of Leamington, and they were prepared to spend any amount of money on it, satisfied that the future would amply repay them. The writer added that the Corporation appeared to entertain a lower estimate of the future of Leamington than the company did. It was ordered that the correspondence should be entered on the minutes.

London.—Newington.—The Vestry has increased the salary of Mr. Blaikie, the resident engineer, from £250 to £300, on the understanding that Mr. Blaikie will remain in the service of the vestry and their successors for a period of two years at this salary.

London County Council.—The Council at the meeting on Tuesday resolved to sanction the borrowing by the Fulham Vestry of £50,519 for electric lighting and refuse destructor purposes, and to make an advance of £25,000 on account of that amount. It was also decided to approve the raising of a loan of £8,579 by the Islington Vestry for street transformers and fittings, and of £21,905 by the Shoreditch Vestry for engineering works at the new generating station. The Council decided not to approve the plan submitted on behalf of the Charing Cross and Strand Company for the construction of a wood and iron building on the roof of the meter room at the station in Commercial Road, on the ground that it was inexpedient to sanction a building of the character proposed.

Bermondsey.—The Vestry will apply to the London County Council for a loan of £21,000, to cover the cost of a dust destructor, chimney shaft, and electric light mains, the repayment of the loan to be spread over 42 years, commencing after three years.

Islington.—Some discussion took place at a meeting of the Vestry on Friday, on the presentation of the report of the deputation who waited upon the Finance Committee of the London County Council, on the subject of the delay in the granting of loans for electric lighting purposes. The discussion did not throw any fresh light on the question than that contained in the report of the deputation, who stated that they explained that the Vestry's officers had given what the Vestry considered to be very full particulars, but that if any further information was desired it would be willingly afforded, and would have been previously given had the Council, instead of asking in general terms for more information, specified the particular points upon which further particulars were required. The matter was discussed fully and in a very friendly manner, and subsequently the chairman of the deputation and the electrical engineer met the engineer of the Council and gave certain expla-

nations of the information already submitted, which satisfied the Council's officials, and the sanctions applied for had now been granted. The chairman of the Council's Finance Committee, after pointing out that much of the delay would have been avoided if the Vestry had previously accepted the invitation in December to meet and discuss the matter, suggested that if any similar difficulties arose in future cases, it would be advisable for the officers on both sides to meet and discuss such difficulties with a view to their settlement.

Pembroke.—The electric lighting scheme is now in working order. The scheme is on practically identical lines with that of the Rathmines Township. The three-wire system, with low pressure direct current, has been adopted. There are now in use 18 arc lamps and 96 incandescent lanterns, with two lamps of 16-C.P. each, for street lighting. There are two sets of high speed compound three-crank engines, each having a normal full load output of 150 KW.; there is in addition a large storage battery. The engines and pipe work were supplied by Messrs. Easton, Anderson and Goolden; three Lancashire boilers by Messrs. Holdsworth & Son, and a fourth (water-tube) by Messrs. Babcock & Wilcox; the condensing plant by the Wheeler Engineering Company; the water-cooling plant by Messrs. Klein, of Manchester; the switchboard by Messrs. Nalder & Thompson, of London; and the storage battery by the Chloride Electrical Storage Syndicate, Limited. The arc lamps were supplied by the British Insulated Wire Company, and the incandescent lamps by the General Electric Company. Lastly, the mains were laid by Messrs. Callender's Cable and Construction Company. As for private lighting, there are adjacent to the mains about 800 houses, and the system is capable of providing for 15,000 lamps of 8-C.P.; there is plenty of room for extensions. There is also abundance of water for all purposes on the site. In connection with the works a Horsfall refuse destructor is erected, capable of destroying 32 tons of refuse per day. Mr. Robert Hammond is the consulting engineer for the works, and his representative in charge of the construction thereof is Mr. L. L. Robinson. The works are being run under the supervision of Mr. S. L. R. Price, resident engineer to the District Council.

Portsmouth.—Mr. E. Price, superintendent of the electric lighting works, in his annual report to the Corporation committee, states that during the past year they spent £5,616 for coal, and sold 1,393,091 units. During the year before they spent £3,798 for coal, and sold 1,224,949 units. These figures work out at ·74 and ·967d. per unit sold. Another cause of the falling off in the net profit is that for some reason there has been a serious falling off throughout the last year in the consumption of energy per lamp connected, amounting to 1·71 units for each lamp, and assuming the number of lamps connected at the middle of the year to be the mean for the year, the decrease amounted to 56,048 units. The average price per unit obtained this year was 4·488d., so that the decrease represented £1,039 reduction of income. This decrease of income, added to the increased cost of coal, accounted for over £1,900. It seemed that the decreased consumption was due to consumers exercising more care in switching off lamps when not required, to their doing with less light, or to the meters not registering correctly. He proposed to test the meters throughout the borough. During the year they had connected 7,090 lamps of 16-C.P., and although this was 192 less than during the previous year, they had connected more consumers. The maximum demand was 1,139 KW. During the year the capital outlay was increased by £20,277. The Local Government Board has sanctioned a loan of £9,775 for electric light purposes.

Plymouth.—Alderman C. H. Radford, Mr. J. H. Rider, borough electrical engineer, and Mr. R. Dingle, of Plymouth, who have been touring in the United States and Canada, landed at Plymouth on 5th inst. from New York.

Provisional Orders are to be sought for—

ALNWICK.—By a company.
BELLINGHAM.—By a company.
BLACKROCK.—By Messrs. Porte, Sykes & Co., of Dublin.
BLACKWELL.—By the Shirebrook Colliery Company.
BUNGAY.—By the North British Electricity Supply Company.
BEAUMARIS.—By the North British Electricity Supply Company.
CHATTERIS.—By the North British Electricity Supply Company.
CAMBORNE.—By the North British Electricity Supply Company.
CLAYTON.—By Messrs. Tahourdius & Hitchcock.
DRIFFIELD.—By the Northern Counties Electricity Supply Company. The District Council will oppose.
FALKIRK.—By Edmundson's Electricity Corporation, Limited, on behalf of the Urban Electric Supply Company, Limited, and by the United Electric Light and Traction Company, Limited. The Town Council will oppose.
FILEY.—By the Northern Counties Electricity Supply Company. The District Council will oppose.
FRIERN BARNET.—By the North Metropolitan Electric Supply Company.
GOMERSAL.—By the North British Electricity Supply Company, and the Northern Counties Electricity Supply Company.
GREAT HARWOOD.—By Messrs. Tahourdius & Hitchcock.
HEXHAM.—By the Northern Counties Electricity Supply Company, and the North British Electricity Supply Company.
INVERURIE.—By the North British Electricity Supply Company. The Town Council consents.
KETTLE.—By the North British Electricity Supply Company.
LINLITHGOW.—By the North British Electricity Supply Company. The Town Council cordially approves.
MARKET HARBORO.—By the United Electric Light and Traction Company, Limited.
MALVERN.—By the United Electric Light and Traction Company, Limited.
NEW ROMNEY.—By Mr. E. H. Shaw. The Town Council will oppose.
PICKERING.—By the Northern Counties Electricity Supply Company. The District Council is favourable.
PONTEFRACT.—By the North British Electricity Supply Company.
ST. ANDREWS.—By the North British Electricity Supply Company.
SPALDING.—By the United Electric Light and Traction Company, Limited.
SOWERBY BRIDGE.—By the North British Electricity Supply Company. The District Council already possesses an order.
SKIPTON.—By the District Council, the North of England Electrical Supply Company, and the North British Electricity Supply Company.
WALMER.—By the North British Electricity Supply Company; and Mr. E. H. Shaw, of Kingston. The District Council will oppose.
WARWICK.—By the British Electric Traction Company.

St. Helens.—At a meeting of the Town Council last week the Mayor said that on March 31st, 1898, 4,526 electric lamps were connected; the cost of producing the current was 4·04d. per unit, and the total cost 6d.; while the sale was over 35,000 units to 63 consumers. In 1899 they had 6,463 lamps, the works cost dropping to a little over 3d. and the total cost to rather less than 4½d., while 65,091 units were sold to 79 consumers at the cost of 6d. At the end of March this year they had 13,981 lamps connected; the works cost had gone down to less than 1d. and the total cost to 1·4d. The sale was 320,160 units, which, of course, included that supplied for the trams. The number of consumers was 190, and there had been an increase in the supply for motors. The output for May was 57,434 units, which was at the rate of 689,000 units per annum, or about double the output last year. Seeing that May was one of the lightest months in the year, the increase was most promising. A profit of £11 had been made last year, and this would be increased this year. In spite of the changing over from the Warrington Old Road station, there had been no serious failure in supplying electricity.

Sleaford.—At a meeting of the District Council last week, Mr. B. Smith, of Oswestry, submitted an estimate for the carrying out of an electric light installation at a cost of £6,500. It was resolved to petition the Local Government Board for power to borrow £7,000.

Stourport.—The District Council has decided not to oppose the application of the Kidderminster Electrical Company for a provisional order for electric lighting if that company agrees to certain conditions.

Trowbridge.—The District Council has decided to appoint Mr. D. Stevenson, electrical engineer, to report upon a system of electrical supply for the town, including the question of a refuse destructor in connection therewith.

Walker.—The District Council has sealed an agreement with the Newcastle Electric Lighting Company for the electric lighting of the district.

Wakefield.—Mr. H. Boulnois, M.I.C.E., held an inquiry at Wakefield last week on behalf of the Local Government Board with respect to an application made by the City Council for sanction to borrow £25,000 to extend their electric lighting scheme. There was no opposition.

Walsall.—At the monthly meeting of the Town Council on Monday it was agreed that the mains be extended, and that two transformers be provided at a total estimated cost of £5,178, subject to Messrs. John Russell & Co., Limited, entering into an agreement to take from the Corporation, for a period of 10 years, electric current of the value of £300 per annum. A communication having been received from the Local Government Board, stating that they proposed to defer sanctioning the loan of £15,000 until the sites for the proposed transformer stations had been decided upon, the Electric Lighting Committee reported that they had instructed the town clerk to urge the Board to sanction the loan immediately, as it is impossible for the Corporation to fix at this date the situation of the transformer stations.

Willesden.—The Electric Lighting Committee has unanimously recommended the Council to adopt Mr. Ruthven-Murray's scheme of electric lighting and electric tramways. The work is estimated to cost about £143,624 for the electric lighting scheme, and £53,247 for the tramways.

West Bromwich.—The Local Government Board has sanctioned the borrowing of £30,000 for land, buildings, and plant for the Corporation electricity works, the repayment to be extended over 25 years.

Wolverhampton.—On Monday last the Town Council resolved that from July 1st the price for energy for lighting purposes be fixed at 6d. per unit, on a maximum demand for an average of 1½ hours per day during the six winter months, that is, from October 1st to March 31st inclusive, and one hour per day during the six summer months—April 1st to September 30th inclusive—and 3d. per unit for all energy consumed in excess thereof.

Worthing.—The Town Council has resolved to instal 40 arc lamps for street lighting, under Messrs. Burstall & Monkhouse's supervision.

ELECTRIC TRACTION NOTES.

Bootle.—At the last Council meeting it was stated that the case of the Bootle Corporation respecting the disagreement with the Liverpool Corporation over the electric tramway rental had been placed before the referee appointed by the Board of Trade, and the decision was expected any moment.

Carnarvon.—The Town Council has received a number of letters from promoters of electric lighting and light railway schemes for the district. A committee will interview all likely promoters.

Govan.—The Tramways Committee of the Glasgow Corporation has approved of the arrangement for the conversion of the Govan and Ibrox tramway lines to electrical working.

Kirkcaldy.—The Town Council last week had before them a report from Prof. Kennedy on the electric lighting and tramway scheme. It was remitted to a committee to report upon the relative cost of the alternative routes.

Light Railways.—The Board of Trade have confirmed light railway orders as follows:—Bexhill and St. Leonards; Cheltenham and District; Cheltenham and District Light Railway (Extension) Order.

Liverpool.—We read in the *Liverpool Mercury* that the lines and overhead equipment on the Old Swan route, in Berry Street, Great George Street, Dale Street, William Brown Street, and at Pierhead will be ready for inspection by the Board of Trade officials in the course of a week or so, and it is not at all unlikely that the electric cars will be running on the West Derby section at the beginning of next month. It is interesting to note that up to the present the mileage of lines laid for electric traction exceeds that of the lines previously utilised for horse cars. Therefore all work in the future will practically be extension. Most important is it to find that when the system is completed there will be duplicate lines from the centre to every quarter of the city, thus greatly minimising the chance of anything like a serious delay in case of a slight mishap on any section.

Middleton.—The Corporation and the British Electric Traction Company have come to an arrangement under which the former will supply electrical energy for working the tramways of the latter. The Local Government Board has sanctioned the Corporation's proposed loan.

Newport (Mon.).—The Town Council have appointed Mr. R. A. Forsyth as inspector to superintend the manufacture of the tram rails for the new Corporation tramline at the maker's works.

Portsmouth.—The Tramways Committee have approved an amended clause which has been issued by the Board of Trade for insertion in the provisional order as to providing workmen's cars. In a report to the Town Council the Committee state:—"Having regard to the fact that an order has been granted by the Board of Trade authorising the construction of about 4½ miles of extension, your Committee recommend the installation at once of a plant sufficient to operate 80 cars, and to provide buildings and chimney of sufficient capacity for further extension in the future. This, together with the rise in prices, necessitates a very considerable increase in the estimate over that originally submitted for a building and plant suitable for a capacity of 60 cars." The estimated cost of the power station plant was £29,373; building and chimney, £9,148; land, £900—total, £39,421. Attention was drawn to the fact that in the cost of the equipment there has been an all-round rise in prices of from 15 to 20 per cent. since the last estimate, and that included in the present estimate are the cost of fitting superheaters to the boilers and the cost of a cast-iron water storage tank, in all about £800, neither of which was provided for originally. Adding this brought the total to £29,000, which agreed very nearly with the present estimate. The building and chimney will accommodate plant to run 120 cars, thus doubling the capacity of the former scheme. The Committee recommend that the above works be approved, and that they be authorised to invite tenders for carrying them out.

At the Council meeting on Tuesday various features of the report were criticised. Mr. H. Kimber, chairman of the Tramways Committee, in reply, said they had provided for one of the finest and most up-to-date stations in the country, and would have ample power to carry on in case of breakdown. The report was adopted by a large majority.

Rhyl.—The Rhyl and Prestatyn Light Railway Company is making every effort to have the electric tramways completed and in working order by April 1st, 1901.

Wolverhampton.—The Town Council has resolved to appoint an assistant engineer for 12 months in connection with the tramway scheme.

TELEGRAPH AND TELEPHONE NOTES.

Grantham Telephones.—The Council will ask for a telephone licence from the Postmaster-General. Canvassing among the public is now proceeding. The Council is advised by Major-General Webber.

Norwich Telephones.—A special meeting of the Town Council was held last week to consider a report from the Executive Committee on an application to the Postmaster-General by the Norwich Mutual Telephone Company, Limited, for a licence for the establishment of a telephonic exchange in the Norwich exchange area. Various recommendations regarding conditions, &c., were made by the committee, and these were discussed at length. An amendment was carried by a small majority providing that a clause be inserted in the agreement to the effect that the whole of the plant and appliances to be used by the new company should be new and of the most modern and approved description, and that it should not be competent for the company to acquire or utilise the business plant and appliances of any other firm or company.

Portsmouth Telephones.—The Town Council having instructed the Finance Committee to obtain a report from an expert as to the cost of establishing a municipal telephone exchange, a sub-committee has been authorised to interview Mr. Bennett, and obtain his report and estimate.

The Telegraph Wire Export Trade.—The returns just issued relating to the exports from this country of telegraph wire and apparatus connected therewith during June last show a big decline on several of the preceding months. The value of the June shipments only amounted to £47,994 as compared with £395,808 in May last, and £27,817 in June, 1899. The activity which has so far this year ruled in this branch of industry, is well indicated by the returns for the six months ending with June last. The aggregate value amounting to no less than £1,459,710, as against £501,673 in the corresponding period of 1899, and £500,896 in the first six months of 1898.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Chinese:—		
Hong Kong-Macao	June 28, 1900	July 9, 1900
South American:—		
Cayenne-Pinheiro	Oct. 11, 1899	
Cayenne-Paramaribo	Feb. 16, 1900	
Pará-Maranham	March 1, 1900	
Ceará-Maranham	Feb. 20, 1900	
West Indies:—		
Jamaica-Colon	June 30, 1899	
Mole St. Nicholas-Cape Haitien	March 6, 1900	
Latakia-Cyprus	June 20, 1900	
Tarifa-Tangier	Jan. 3, 1900	
Gibraltar-Tangier	June 28, 1900	July 5, 1900
Landlines:—		
Chinese:—		
Tientsin-Pekin	June 12, 1900	
Pekin-Kalgan	June 14, 1900	
Kalgan-Maimatchin	June 30, 1900	
Tientsin, *viâ* Shanghai	June 16, 1900	
Tientsin-Niuchwang	June 18, 1900	
South American:—		
Barcelona, Venezuela-Cindad-Bolivar	July 2, 1900	July 4, 1900
" " " "	July 6, 1900	July 10, 1900
Communications with all offices of Columbia beyond Buenaventura	January 23, 1900	
Ecuador landlines	March 13, 1897	
Landlines south of Macahé (Brazil)	April 25, 1900	
Communication "*viâ* Hanekine" interrupted on Persian territory	Feb. 24, 1900	

Wireless Telegraphy.—In the House of Commons last week, in reply to Sir R. Penrose-Fitzgerald, Mr. Ritchie said the wireless telegraphy communication between the East Goodwin light vessel and the mainland was established for experimental purposes only and has now been discontinued. I am not aware of the exact nature of the system in use on the Borkum light vessel. The question of using a system of wireless telegraphy for purposes of communication with lighthouses and light vessels is before an inter-departmental committee, who have very difficult questions of patent rights to consider.

In the House of Commons on Tuesday, in answer to Sir R. Penrose-Fitzgerald, Mr. Ritchie (Croydon) said, according to the *Times* report, the inter-departmental committee on the question of wireless telegraphy for life-saving purposes was appointed to consider and report (*a*) with respect to the provision and maintenance of communication between outlying lighthouses and light vessels and the shore, and whether any, and if so what, extension and improvement can be made therein, special regard being had to a system of wireless telegraphy; (*b*) how far and subject to what conditions the means of communication with such light stations can be made available for private messages without affecting the efficiency and safety of the lighthouse service; and (*c*) how far the connections between shore lighthouses and post offices or coastguard stations should be made available for private messages. This committee has superseded that which was appointed in consequence of the recommendation contained in the final report of the Royal Commission on electric communication with lighthouses and light vessels, and comprises representatives of the Board of Trade, Admiralty, Treasury Post Office, and Trinity House.

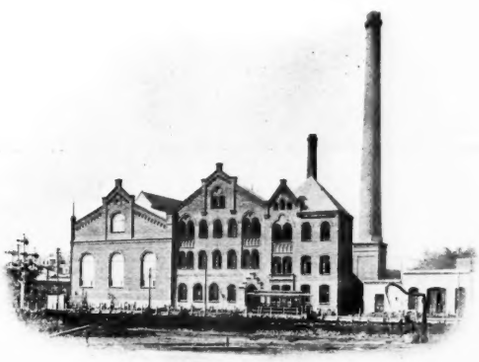
THE ELECTRIC LIGHTING AND TRAMWAYS OF BUENOS AIRES.

The public supply of electricity in Buenos Aires dates from about 1888. From that year, until 1898, it was in the hands of two companies, one of the strongest gas companies being one, and the other a private firm; both seemed to suffer from a lack of enterprise, probably for want of capital. The private firm of Sr. Rufino Varela is the one which formed the nucleus of the system about to be described. It owned two small stations, one a direct current system of 250 KW. capacity in the basement of the Opera House, and the other a mixed alternating and direct current at the rear of the Politeama theatre. Almost all the theatres were supplied with electricity from one of these two stations. In 1897 the Cia. General de Electricidad was formed in Paris to acquire and develop the concessions and systems owned by Sr. Rufino Varela, jun.

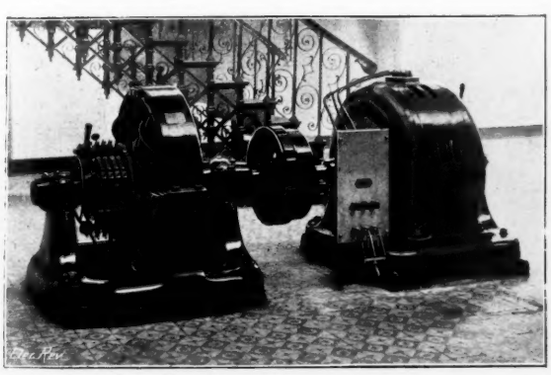
The capital of 6,000,000 francs was raised in Buenos Aires, Paris, and Berlin, the headquarters being in Paris; in fact, in Buenos Aires it is known as a French company. A contract was at once drawn up and signed with the Union Electricitäts Gesellschaft, Berlin, for the complete equipment of the new system, from the coal pile to the consumers' meters, and Count Charles Cicogna was appointed engineer and manager in Buenos Aires. The contractors immediately sent one of their engineers, Mr. W. S. Hulse, to Buenos Aires to get the data necessary for the drawing up of the plans in Berlin; after having arranged the necessary details he again returned to Buenos Aires to take charge of all the construction, with Mr. J. T. Cornish as chief assistant.

The system finally adopted was the monocylic alternating current, generated at 3,400 volts, and distributed from transformer sub-stations on a three-wire network, having 230 volts between the outers, and 115 at the lamps.

A suitable piece of land was bought in the Paseo de Julio, about half way between the Retiro railway station and the waterworks; its position, about 250 m. from the river bank, made it convenient for obtaining water for condensing, and the facilities for discharging coal were also good.



GENERATING STATION.



THREE-PHASE MOTOR AND EXCITER.

On this ground a temporary station was at once erected, to help out the overloads of the other stations, and also to carry out a contract to supply the Buenos Aires and Belgrano Tramway Company with power to run their system.

The buildings for the new station were commenced immediately, and before the roof was on the engine room, one of the 500-KW. sets was running under a temporary wooden shed; it continued to run thus for more than three months, taking steam from the boilers in the temporary station.

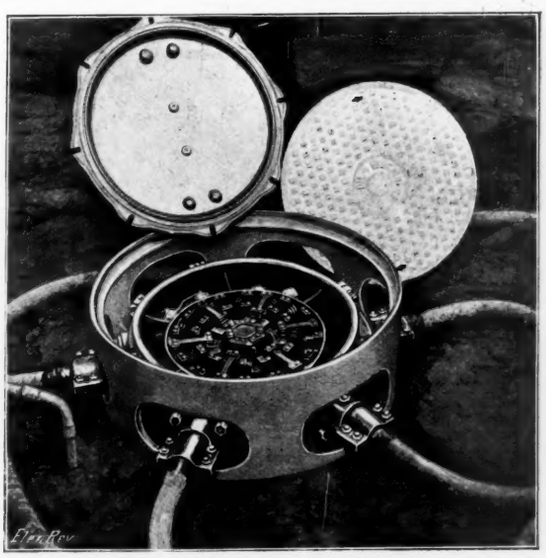
The site of the generating station is at the northern side of the city, and at the periphery of the distributing area; it is within 100 yards of the most fashionable residential district, Avenida Alvear, and it speaks well for the construction and management that no complaints have ever been made as to smoke, exhaust steam, or vibration, notwithstanding the large size of the station.

The new buildings, which cover an area of 2,730 sq. m., are of red brick, and comprise engine room and basement, boiler room, pump room, offices, stores, repair shops, lavatories and wardrobes for the men, and a suite of dwelling rooms for the engineer-in-charge.

The boiler room is parallel to the engine room, and now contains eight Belleville water-tube boilers, built by the firm of Delaunay, Belleville & Co., of St. Denis, and arranged in four batteries of two each, four boilers on each side of the room. The chimney is 60 metres high and 2·40 metres diameter at the top. It is lined with firebrick to a height of 45 metres, an air space of 6 cm. being allowed between the lining and the wall of the chimney.

The Belleville type of water-tube boiler consists essentially of an upper steam cylinder and a lower water chamber, with a series of straight tubes, arranged in zig-zag, connecting them. The generating tubes are in vertical groups, technically termed elements, and are placed in such a manner as to form a kind of flattened spiral of 12 straight tubes; detail views of one of these elements appear on a later page. The ends of the tubes are connected together by being screwed into cast-steel boxes, which form the turns of the spiral.

The connections are made so that the whole 12 tubes form one continuous passage for steam and water from the bottom to the top. The water, after having passed through any tube, has to traverse a short distance horizontally through the end boxes to obtain access to the next tube in its ascent. The front of the lowest part of each element is connected to the steam collector. There are 10 of these elements in each boiler. The inclination of the tubes is very small, being only $2\frac{1}{2}°$ to the horizontal.



STREET FUSE BOX AND CABLES.

The series of 10 elements are placed side by side. The mixture of steam and water generated in the tubes is dis-

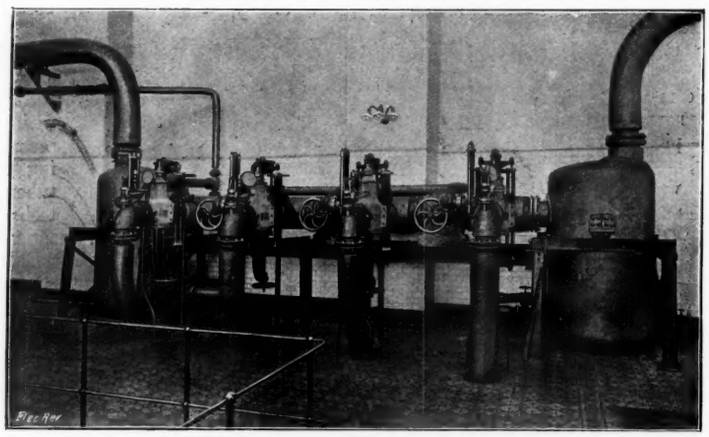
charged into the top steam collector from the tops of the elements. In this collector the steam is separated from the water by means of a series of baffle plates, the steam being drawn off by means of the stop valve and the water flowing back along the bottom of the collector to the return water pipes on each side, and thence again to the elements.

The feed is admitted through a small non-return valve at the middle of the top collector through a small orifice at a pressure of 450 lbs., which is considerably higher than the actual working pressure of 225 lbs.

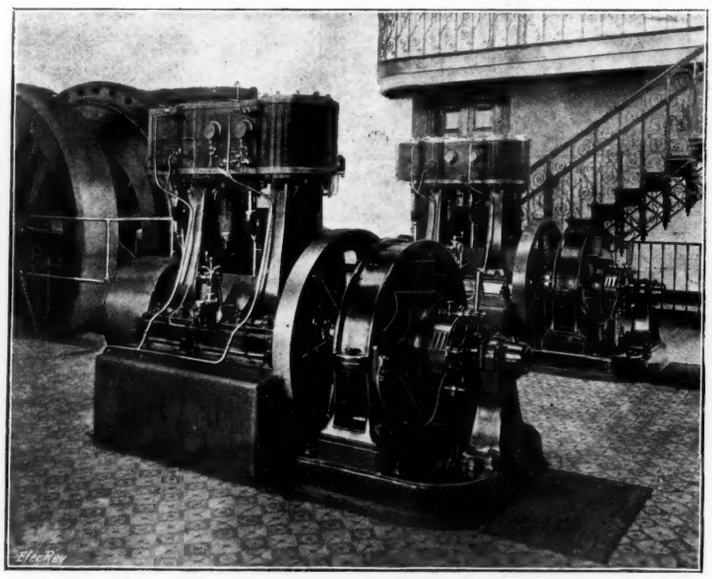
The automatic feed apparatus consists essentially of a chamber connected at top and bottom with the elements of the boiler, and to which the gauge glass is attached. This chamber contains a hollow float which is connected by a system of levers with a valve on the feed pipe.

The space between the fire and the lowest tube is not large, so that unless complete combustion of the gases takes place within a short distance of the fire, it will take place above the lowest tubes and much heat will pass off to the chimney, which, had the combustion taken place lower down, would have been abstracted by the water in the tubes. With a properly regulated and thin fire which passes the proper amount of air, there is less liklihood of this, but it has been found that the forcing of steam in small jets above the fire has a beneficial effect in thoroughly mixing the gases and also in accelerating the rate of combustion. It should be observed that the apparatus is purely for mixing the gases, and not for forcing the rate of combustion of the coal. The arrangement consists of a square pipe about 12 inches above the fire bars, with a series of nozzles slightly inclined downwards and discharging steam among the gases above the fire with sufficient force to reach all parts of the furnace and thoroughly mix the combustible gases with the oxygen.

Water-Tube Boilers.



Reducing Valves and Main Separators.



Steam-driven Exciters.

The heating surface of each boiler is 106 sq. m. and the output 3,750 kg. of steam per hour.

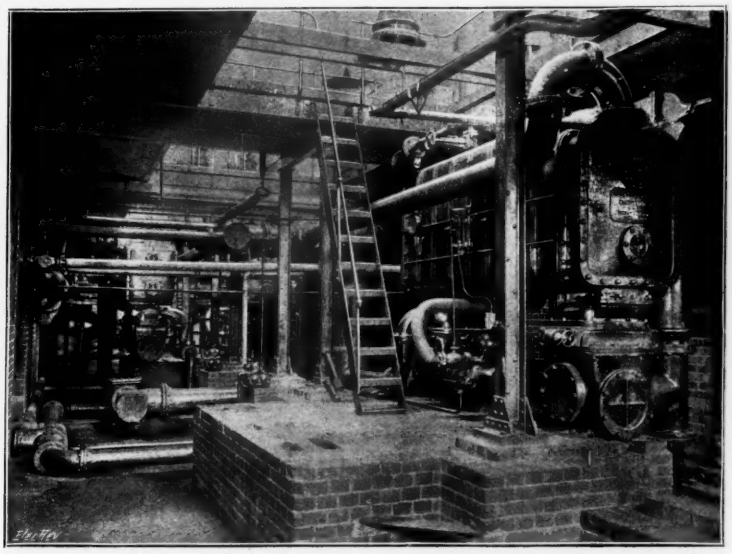
A safety device is fitted to each element in the shape of two fusible lead plugs, which are driven into small holes bored into the front of the tube boxes, one near the upper part and one near the lower part of each element. By means of a special plug driving tool these can be replaced while the boiler is under pressure.

Every boiler is fitted with a separate economiser, which in form and general arrangement is exactly similar to the boiler elements; the tubes, however, are shorter and of smaller diameter. The economiser is placed about 4 feet above the top of the generator, and the hot gases pass through it on the way to the chimney. The boilers are hand fired, and coal is brought into the room on a small Koppel railway, there being a track on each side of the room equipped with three turntables.

In the pump room are three Belleville pumps, two of which are capable of feeding all the boilers. These take their water from two small tanks of a combined capacity of 35 tons. There is no lack of feed water supply, which can be taken from either of the following sources:—(1) Hot well; (2) river water, before or after circulating through condensers; (3) artesian well No. 1; (4) artesian well No. 2; (5) city water supply.

The boilers feed into a main steam ring of mild steel

pipes, with steel flanges and copper bends; to allow for expansion there are two double S copper expansion bends. The smaller steam pipes are of Mannesmann patent weldless steel. The feed pumps have an independent steam ring, and the feed is also arranged on the ring system. From the main steam ring two separate pipes lead into the engine room.



Condensers and Pumps.

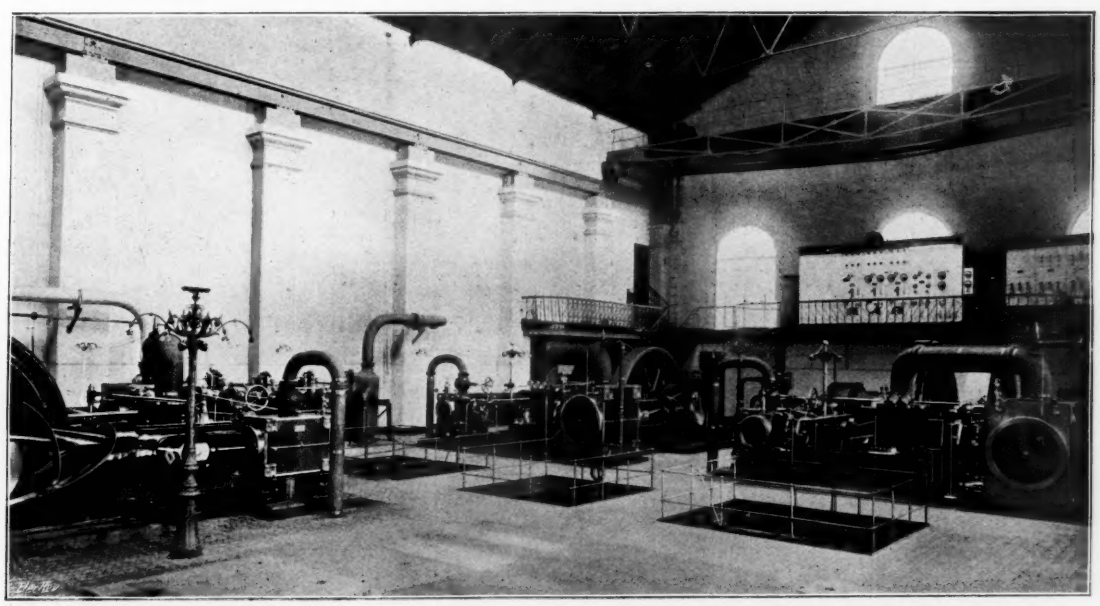
The engine room is of generous proportions, being 36 m. long by 22 m. wide, and 13 m. to the top of the electric overhead traveller. The total height to the steel trussed roof at the apex is 18½ m. The walls are glazed to a height of 2½ m. with white tiles, and the floor is covered with mosaic tiles. Here there are four 500-KW. 3,400-volt monocyclic alternators, each mounted on the shaft between the crank discs of a horizontal compound engine, two 30-KW. steam exciters, and a 30-KW. motor-driven exciter.

The main engines are by the E. P. Allis Company, of Milwaukee, with cylinders 20 inches and 40 inches by 36 inches stroke, and run at a speed of 125 r.p.m. They are fitted with the usual Allis-Corliss valve gear, driven by double wrist plates on each cylinder, which are actuated by two eccentrics, one steam and one exhaust. The cut-off is regulated by a Reynolds automatic governor controlling the H.P. 35½ tons. The governor is provided with a knocking-off gear, so that in case the belt should break the steam is immediately shut off, thus preventing the running away of the engine.

Each engine is provided with an independent Wheeler surface condenser of the Admiralty type, of 1,000-H.P. capacity, so as to be able to cope with an overload. These condensers are placed in the basement of the engine room, where they are easily overlooked by the driver without leaving his engine, as there is an open hatchway in the floor which gives a full view of them.

Between the low pressure cylinder and the condenser there is an automatic exhaust valve which allows the engine to exhaust to the atmosphere in case the vacuum fails. The air pump sends the condensed water to the hot well, which also receives the condensed steam from the traps; the hot well pump forces the water into the feed tanks, passing on its way through two Germania oil filters. These separate from it the large quantity of oil which is used in the cylinders of the engines.

The exciter engines are made by Gritzner, of Durlach; they are of the vertical compound type, with piston valves to both cylinders, the cut-off being controlled by a shaft



General View of Engine Room.
A fourth set has since been erected in the foreground.

cylinder only when running on a lighting load, but when the alternators are used to drive the new motor-generator set for the tramway, the governor can be arranged to control the L.P. side also. The piston speed is 750 feet per minute. The fly-wheel, which is very massive for its diameter of 12 feet, weighs 17½ tons, and the whole crank shaft, with fly-wheel, field magnets, and crank disc, weighs

governor, which varies the travel of the high pressure valve. The cylinders are lubricated by a small force pump driven by the shaft; the main bearings of the crankshaft are lubricated by oil rings, all other wearing surfaces being fed from two small tanks. The cylinders are 225 and 340 mm. diameter by 240 mm. stroke, the speed being 325 r.p.m. These engines take their steam from any of the engine

reducing valves, and can exhaust to any of the condensers or to the atmosphere.

The dirty oil is drained through piping from all parts of the engines to a tank in the basement, whence it is forced by a hand pump to a filter, a motor-driven pump lifting the oil to the tanks in the engine room.

The steam system in the engine room is somewhat new in central station practice, and as far as is known is not used in any English or American station. The steam pipes leave opposite ends of the boiler room, taking steam at 210—225 lbs. into the engine room, where they are inter-connected; from this point branch off four regulating reducing valves *(regulateur-détendeur)*. At each end of the group of reducing valves there is a very large separator with baffle plates, through which passes all steam entering the engine room. Each of these reducing valves is connected to one engine; the steam passes through two other separators before entering the high pressure cylinder, a branch being taken off to the auxiliary starting valve of the low pressure cylinder and one to the condenser steam pump.

Avenida Alvear.

Each engine is dependent on a low pressure system of its own which is controlled by the reducing valve; this has a range of from 40 to 130 lbs., and this pressure is adjusted by hand according to the load on each engine. For a traction load, the steam pressure cannot be adjusted so closely as for a lighting load, otherwise the engine would not be able to respond quickly enough to the sudden variations which are incident to the service. The reducing valves were furnished by the Belleville Company. With the exception of these valves and the main steam pipe entering from the boiler house, all piping is carried in the basement, which is about 9 feet high; this allows an unobstructed view of the engine room, and gives easy access to all joints. The main piping is carried on rollers, so that it can move freely under expansion. The whole of the piping in the station is covered with magnesia, and was furnished by Seiffert, of Berlin.

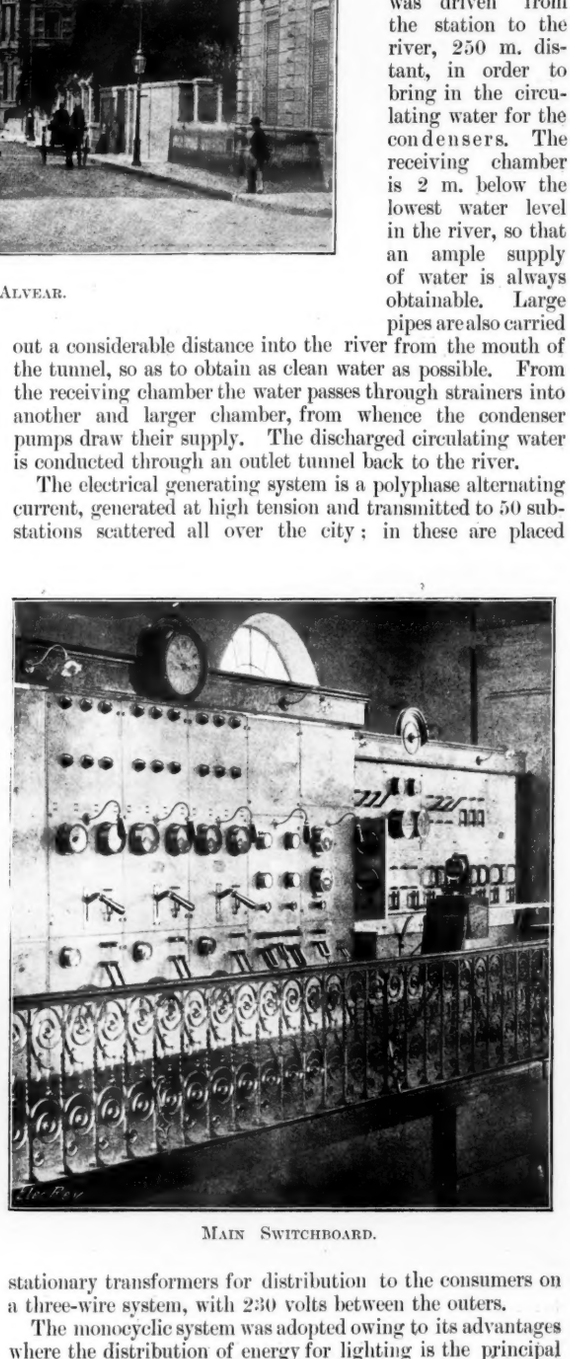
The separators are all drained to the hot well by Kuntz patent expansion traps.

A large tunnel was driven from the station to the river, 250 m. distant, in order to bring in the circulating water for the condensers. The receiving chamber is 2 m. below the lowest water level in the river, so that an ample supply of water is always obtainable. Large pipes are also carried out a considerable distance into the river from the mouth of the tunnel, so as to obtain as clean water as possible. From the receiving chamber the water passes through strainers into another and larger chamber, from whence the condenser pumps draw their supply. The discharged circulating water is conducted through an outlet tunnel back to the river.

The electrical generating system is a polyphase alternating current, generated at high tension and transmitted to 50 sub-stations scattered all over the city; in these are placed stationary transformers for distribution to the consumers on a three-wire system, with 230 volts between the outers.

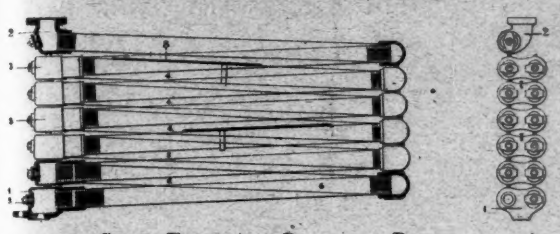
The monocyclic system was adopted owing to its advantages where the distribution of energy for lighting is the principal consideration, and where the demand for motive power is small or remains to be developed.

Boulevard Callao.



Main Switchboard.

In this system there is a main circuit for lighting, which works in combination with a supplementary circuit, whose electromotive force is in quadrature with the former, and is approximately one-fourth its value, for power purposes. The lighting system is then a purely single-phase one, and the work of its supply can be carried out in the usual simple



Spiral Element of Belleville Boiler.

way. The supplementary or "teaser" circuit, as it is called, combines with the principal circuit in a special transformation in the sub-stations in such a way as to operate three-phase motors with all their well-known advantages. In this special transformation the lighting transformers are connected to power transformers, so that the maximum output is obtained from the apparatus already installed.

(*To be continued.*)

CONTRACTS OPEN AND CLOSED.

OPEN.

Aston Manor.—July 24th. The Council wants tenders for steam dynamo, motors, switchboard, pipe work, battery, pumps, arc lamps and posts, crane and wiring. See "Official Notices" to-day.

Beckenham.—July 16th. The District Council wants tenders for a free wiring contract. See "Official Notices" June 29th.

Belgium.—July 14th. The municipal authorities of Jumet are inviting tenders until July 14th for the concession for the public and private electric lighting of the town. Tenders to be sent to Le Secretariat Communal, L'Hotel Communal, Jumet, Belgium, whence particulars may be obtained.

Blackpool.—July 23rd. The Corporation wants tenders for trolley poles, cables and trolley wire, boosters and switchboards, and storage battery. See "Official Notices" June 22nd.

Brussels.—September 19th. The Council of St. Jilles, lez Bruxelles, invites tenders for the installation and the commencement of supply upon a part of its territory. Conditions and plan for three francs at the office, No. 14, Parvis St. Jillies, St. Jilles.

Cardiff.—July 24th. The Corporation wants tenders for 10 30-kw. transformers. See "Official Notes" to-day.

Darlington.—July 28th. The Corporation wants tenders for arc lamp-posts and brackets. See "Official Notices" to-day.

Durban.—July 20th. The Corporation wants tenders for overhead equipment for (*a*) about 16 miles of single track, including poles, overhead trolley wire, distribution boxes; (*b*) 22 double-deck motor cars; (*c*) steam and electric generating plant, including three 250-kw. generators, boilers, condensers, cooling towers, switchboard, &c. See "Official Notices" May 18 and June 15th.

Germany.—July 25th. Tenders are being invited until July 15th by the Baden State Railway authorities at Carlsruhe for the supply of two large multiphase alternators required for a central station they are establishing at Mannheim. Tenders are to be sent to Die General Direction der Grossl Badische Staatseisenbadnen Carlsruhe, where particulars may be obtained for 3s.

Germany.—July 28th. Tenders are being invited until the 28th inst. by the State river authorities at Emden for the supply and erection of three 1½-ton electric wall cranes, and a 40-ton electric swing crane. Tenders to be sent to Die Königliche Wasserbaninsfertion, Emden, Germany, whence particulars may be obtained for 2s.

Grays Thurrock.—August 9th. The Council is inviting tenders for Lancashire boilers, 100-kw. steam dynamos, economisers, switchboards, battery, crane, mains, and other plant, &c. See "Official Notices" June 29th.

Halifax.—July 31st. The Corporation wants tenders for a steam engine and alternator, alternators, static transformers, induction motors, rotary converters, and three-phase extra high tension switchboard. See "Official Notices" to-day.

Hull.—July 23rd. The Corporation wants tenders for the electric lighting installations and fittings for the Springhead pumping station. See "Official Notices" to-day.

Hull.—July 26th. The Electric Lighting Committee wants tenders for five high tension continuous current rotatory transformers with switch gear and accessories. See "Official Notices" to-day.

Islington.—July 25th. The Vestry wants tenders for relaying York and other stone over electric conduits and mains. See "Official Notices" July 6th.

Italy.—July 14th. The municipal authorities of Maddalena (Sardegna) are inviting projects and tenders until July 14th for the electric lighting of the public streets of the town. Particulars may be obtained from, and schemes and tenders are to be sent to, Il Municipio di Maddalena (Sardegna).

Madrid.—August 18th. Tenders are invited by the Spanish Government, not later than August 18th, for the concession of a system of electric tramway lines in Barcelona. Some particulars may be examined at the commercial department of the Foreign Office between 11 a.m. and 5 p.m.

Manchester.—July 21st. The Tramways Committee wants tenders for the electrical equipment of 150 cars. See "Official Notices" to-day.

Newport.—The Newport (Mon.) Borough Council are prepared to receive tenders for Bessemer steel girder rails, Bessemer steel fishplates, wrought-iron tie bars, fish-bolts, nuts, and washers, for the new electric railway on Corporation Road.

Rochdale.—July 14th. Tenders are invited for wiring the municipal technical school for electric lighting. See "Official Notices" July 6th.

Roumania.—July 17th. Tenders are being invited until the 17th inst. by the Roumanian Post and Telegraph authorities in Bucharest for the supply of 40 tons of galvanised steel wire, 2 mm. diameter.

Salford.—July 16th. The Corporation wants tenders for overhead equipment for the electric tramways, exclusive of the supply of poles, but inclusive of their erection. See "Official Notices" June 22nd.

Salford.—August 13th. The Corporation wants tenders for lighting cables, tramway feeders, and street lighting. See "Official Notices" to-day.

Sheffield.—July 21st. The Corporation wants tenders for 12¼ months supply of transformers. See "Official Notices" to-day.

South Shields.—July 14th. The Guardians want tenders for an electric light installation at the Union Workhouse, Harton, South Shields. See "Official Notices" June 22nd.

Southend-on-Sea.—July 25th. The Corporation is inviting tenders for (*a*) boilers and auxiliaries; (*b*) steam generators, and switchboards and crane; (*c*) feeders and distributors; (*d*) line equipment; (*e*) trucks and car equipments. Specifications, &c., from Mr. Alfred Fidler, A.M.I.C.E., borough engineer. Deposit three guineas.

Spain.—July 21st. The municipal authorities of Algemesi (Province of Valencia) are inviting tenders until July 21st for the concession for the electric lighting of the town during a period of 10 years. Particulars are to be obtained from, and tenders to be sent to, El Secretario del Ayuntanicente de Algemesi (Valencia).

Stockport.—August 31st. The Tramways Committee wants tenders for 20 double-deck tramcars with electrical equipments. See "Official Notices" to-day.

Sunderland.—July 27th. The Corporation wants tenders for a coal conveying plant for the electrical supply station. See "Official Notices" to-day.

Warsaw.—August 28th. The Secretary of State for Foreign Affairs has received a despatch from Her Majesty's Acting Consul-General at Warsaw stating that tenders are invited by the Russian Government, not later than the 28th prox., for the telephone service of Warsaw, St. Petersburg, Moscow, Odessa, and Riga. Some particulars may be examined at the Commercial Department of the Foreign Office between 11 a.m. and 5 p.m.

Wimbledon.—July 18th. The District Council wants tenders for supplying and fixing telephones at the Isolation Hospital. See our "Official Notices" July 6th.

CLOSED.

France.—The French Ministry of Posts and Telegraphs has just given out contracts for the supply of a quantity of electric cable as follows: La Société des Telephones, Paris, 240 kilometres, and Messrs. Aborlard & Co., of Paris, 148 kilometres.

London.—The Middlesex County Council have accepted the tender of Messrs. Rosser & Russell, amounting to £81 5s., for

the supply of radiators and an electric fan for the record room at the Guildhall, Westminster.

The Lambeth Vestry have received the following tenders for the extension of the electric lighting system at the baths in Kennington Road :—

Geipel & Lange	£90 10 0
Woods & Co.	67 0 0
Walter Mossop & Co. (accepted)	48 15 6

Newington.—The Vestry has accepted the tender of the British Insulated Wire Company for insulated electric mains at £9,026.

London.—The London County Council on Tuesday considered the following tenders for the supply of engine, dynamo, and wiring in connection with the electric lighting of the Farmfield Reformatory :—

OIL ENGINE.

Bilbie, Hobson & Co. (Hornsby-Akroyd engine) (accepted)	£257 0 0
Priestman Brothers	312 5 0
Crossley Brothers	324 0 0

WIRING, &c.

	Wood casing.	Steel tubing.
Tamplin & Macovskie (accepted)	£309 14 6	£360 0 0
Strode & Co.	349 0 0	373 0 0
Concentric and General Contract Company	360 0 0	440 0 0
F. A. Glover & Co.	407 0 0	450 0 0
Wood	484 0 0	530 0 0
E. P. Rickson	678 0 0	700 0 0

DYNAMO.

Parker & Co., 700 revolutions per minute	£165 unfixed.
,, 900 ,, ,,	143 ,,
Electrical Construction Company, 630 revolutions per minute (accepted)	189 fixed.
India-rubber, Gutta-percha, and Telegraph Works Company, 600 revolutions per minute	130 unfixed. 136 fixed.
Siemens Brothers, 720 revolutions per minute	182

BATTERY.

	70 amp. short.
Chloride Company	£183
Electrical Power Storage Company (accepted)	158

British Insulated Wire Company (accepted), cable at £174 per mile.

Portsmouth.—The Electric Lighting Committee have received tenders for six transformers, and, on their recommendation, the tender of the British Electrical Manufacturing Company, being the lowest, has been accepted by the Council. Tenders :—

British Electrical Manufacturing Company	£528
Messrs. Siemens Bros.	714
Messrs. Ferranti	681

Wakefield.—The Electric Lighting Committee have accepted the tender of Messrs. John Fowler & Co. for two transformers, and that of Messrs. E. Green & Son for two feed pumps.

Wolverhampton.—At the Council meeting on Monday the tender of Messrs. Green & Son, Manchester, amounting to £561, for the supply and fixing of economisers was accepted, as was also the contract of the St. Helens Cable Company, Limited, for the supply of electric lighting cables.

FORTHCOMING EVENT.

Saturday, July 14th.—Institution of Junior Engineers. Excursion to Tring Park to inspect Lord Rothschild's electric lighting and power installation.

NOTES.

Obituary.—We regret to report the death of Senor Don Francisco de Paula Vasquez, who died at Madrid on the 24th of last month after a comparatively short illness. Mr. Vasquez, who was only 61 years of age, had been a high official in the Cuerpo de Telegrafos, and was honorary local secretary in Madrid to the Institution of Electrical Engineers, as well as agent for the Spanish National Telegraph Company, and the South American Cable Company. Many of our readers will have pleasant recollections of meeting Senor Vasquez at the Telegraph Conference at Paris, where his kindly humour and sympathetic manner gained for him many English friends, who we are sure will join us in expressing our condolences with his family and with his many friends in Spain.

Presentation.—Mr. F. S. Ransome, the assistant works manager at the Falcon Works of the Brush Electrical Engineering Company, Limited, was on Monday last presented with a carriage clock and a recording barometer, on the occasion of his marriage, which took place at Bedford on Wednesday.

The Fourth of July.—It is a question whether London has been taken by the invasion of American engineers or whether American engineers were taken by London, but anyhow it occurred to Messrs. Philip Dawson, James Dredge, Robert Blackwell and A. F. Yarrow, who had been on several occasions recipients of American hospitality, that the 4th of July afforded an opportunity of showing to some small extent their appreciation of the many kindnesses they had received on the other side of the Atlantic. They therefore arranged for this great anniversary the following programme for a few American friends :—

Programme for July 4th, 1900.—Meet at Waterloo to go to Surbiton ; take Mr. Yarrow's steam launch, the *Cintra*, and proceed up the Thames to Staines ; lunch on board ; reception by Mrs. Dawson at The Gables, Staines ; train from Staines for Waterloo ; dinner at the Hotel Russell to meet a few English friends.

The list of those invited included the following gentlemen :—H. F. Parshall, Esq., G. R. Dunel, Esq., Col. Hunsiker, Col. Haines, — Swasey, Esq., G. W. Dickie, Esq., R. W. Hunt, Esq., Ch. H. Morgan, Esq., H. B. de Parsons, Esq., Jesse M. Smith, Esq., C. Fisher, Esq., O. Smith, Esq., John E. Sweet, Esq., H. H. Suplee, Esq., Major W. H. Wiley, J. A. Burden, Esq., John Thompson, Esq., Sir Benjamin Baker, Sir W. H. Preece, J. E. Kincaid, Major P. Cardew, C. A. Knight, Esq., W. J. Clark, Esq., and W. J. P. Moore, Esq.

After this invitation had been sent out, Mr. Manville kindly came in and placed an electric launch at the disposal of the party at Staines, which took them up to Magna Charta Island, which is his summer residence. The American guests were delighted at the reception given them, especially at being received by Mrs. Dawson at Staines, where coffee was served, and then by Mrs. Manville at Magna Charta Island, where tea was partaken of.

The Anglo-American Engineers' dinner at the Hotel Russell fittingly brought to an end the day's entertainment, and if the cordial and fraternal references made by representative American engineers voiced the real feeling of the new country for the old, we need be in no fear of strained relations between ourselves and our trans-Atlantic cousins. We think the plastic bond is made never to be severed, and as the American Ambassador gracefully remarked at the dinner of the American Society in London on Independence Day : —"'The Day We Celebrate' was no longer a national, but had become an international, holiday : and in future, instead of being an American festival, it would be an Anglo-American one. The time had come when the two great nations upon whom Providence seemed to have cast so vast a share of responsibility for the future were to be friends, not only for their own sakes, but for the sake of all mankind."

Electricity and Potato Cultivation.—In the House of Commons last week, Mr. Austin (Limerick, West) asked the Vice-President of the Board of Agriculture and Technical Instruction for Ireland if his attention had been directed to a series of experiments made by Mr. O'Sullivan, of Athea, in the county of Limerick, with a view of improving potato growing ; whether he was aware that under this new system an increase of 80 per cent. in the crop was shown ; and would the department cause inquiries to be made into the matter. Mr. Plunkett (Dublin County, S.) in reply, said that his attention had been called to the experiments referred to in the question. Mr. O'Sullivan attributed the extraordinary increase in his potato crop to the action of electricity introduced through lightning conductors and distributed through the crop by means of wires. As both the parish priest of Athea and the county surveyor of Limerick are satisfied both as to the effect and the cause of this remarkable phenomenon, he would have inquiries made on behalf of the department.

Personal.—The Halifax Town Council has agreed that the salary of Mr. H. F. Street, the electrical engineer, be advanced on October 1st from £300 to £400 per annum.

Mr. G. L. Andrews, B.Sc., assistant engineer to the Hull Corporation Tramways, has been appointed chief engineering assistant to the Sunderland Corporation Tramways.

Boiler Explosions Inquiry.—The 1,228th report on preliminary inquiries is of interest as having reference to an explosion of a water-tube boiler at Tunbridge Wells electricity works. The boiler was one about 21 feet long, and had 72 tubes of 4 inches diameter. These were lap-welded in the usual system of water-tube boilers, whereby makers of such boilers have so seriously jeopardised the whole character of the water-tube boiler. The explosion was due to one of these welded pipes giving way. Two splits of $2\frac{3}{4}$ inches × $1\frac{1}{2}$ inches opened up near the front header of one of the tubes in the fourth row from the bottom. We need hardly point out how entirely insufficient is a test pressure of 300 lbs. per square inch to prove sound or unsound welds. An 8-foot diameter Lancashire boiler, about $\frac{5}{8}$-inch thick, is tested to 240 lbs. or more. This corresponds with a pressure on a 4-inch tube, say, $\frac{1}{4}$-inch thick, of 2,300 lbs., and even this would not start a bad weld in many cases. The immediate cause was an accumulation of scale inside the tube. The most satisfactory point that came out in evidence was that the Hopkinson isolating valve acted at once and shut off the steam from the steam main, that would otherwise have escaped through the damaged boiler from the other boilers connected to the same main. We think that makers of water-tube boilers would be well advised to adopt solid drawn tubes in place of lap welding. It appears from the evidence that the mud-drum of the exploded boiler was made of cold blast iron and steel scrap —a sort of toughened cast-iron, we presume, which should not be admitted in a steam boiler. We regret to find that there is an attempt among boiler makers to introduce even malleable cast-iron into steam boilers in the shape of the mounting blocks for Lancashire boilers. This is a practice that should be heartily condemned. We have had some personal experience with malleable cast-iron pipes, and found them anything but good. They had bad blow holes at the chaplets for one thing, and were very uneven in texture and very difficult to face up and drill.

Fiat Justitia.—Journals, like individuals, sometimes get credit for things they have never said or done. For our own part we feel very conscientious on this point as we are believers in the old maxim, "Honour to whom honour is due." We prefer to bear just that measure of honour which is really due to us and no more. Now the Electrical Review, of London, and the *Electrical Review*, of New York, are not one and the same. Far be it from us to attempt a comparison, but because our contemporary bears our title it does not follow that we ought to be showered with the fruits of its victories. Our contemporary is quoted in the American daily press far more than is any English technical journal in the English newspaper press, and sometimes its striking articles are in the course of events copied into English papers without the necessary indication that the comments are those of the New York paper. It is easy thus to see that we are saddled with undeserved kudos, and our contemporary is robbed of its merited laurels. We are sorry that this is so, for sometimes the views set forth are not by any means on all fours with our own. As an instance let us quote the recent great effort made at Park Place editorial sanctum to prove "that the chances of death by lightning are so remote as to be utterly negligible," and to prove the lightning rod to be useless. The article was very strong and sweeping in its terms, and it aroused much attention among those who had hitherto placed a certain confidence in the efficiency of the means so long employed for protecting buildings. But the views were not ours, and we have no desire to bear the responsibility for them. Perhaps *Invention* and other English papers which have so freely quoted the matter will take a note of this?

The Views of a Colonial.—Mr. J. R. Bainton has just entertained a meeting of the Electrical Association of New South Wales with a paper on "The Electrical Industry in America and Great Britain," in which he gave his impressions of a number of the principal electric lighting, railway and power plants which he had inspected on a tour round the world. He concluded by expressing himself very much disappointed with the electrical industry in England as compared with America.

Combined Lighting and Traction Stations.—*A propos* of the remarks on this subject in our last issue, one of our most distinguished engineers, who has had wide experience in both lines, recently expressed himself to us as strongly opposed to the system of joint management. In his opinion the proposal usually originates on the lighting side, from a desire to make an undertaking, which is not particularly remunerative, more so, by harnessing what should in the normal case be a profitable undertaking, if the management has been the very best from the beginning, to one which requires bolstering up. Lighting engineers, by their education, are not naturally qualified to be in sympathy with the rough and ready requirements as to electric supply of a traction system. A first-class traffic manager will fight to the last to carry every passenger in the street, regardless of what happens in the station, and a lighting engineer generally thinks first of his machinery. An intimate acquaintance with the working of some installations where there is a joint management leads to the conclusion that, under this condition, either one or the other, or both departments, will suffer. In the favourable case nothing can be combined with advantage except the supply of current, and this on the basis that the plant is designed initially with a view to supplying current for traction, in which case it will, of course, respond to the most extraordinary demands which may arise for lighting.

From actual experience he is not satisfied that, in the majority of cases, even a joint supply is particularly advantageous from a commercial point of view. It is true the lighting generally shows up to advantage under this condition, but in every case with which he is familiar this is on account of charging off a greater proportion of capital to the traction undertaking. Generally the combination is brought about to increase the sphere of action, likewise the salary, of some aspiring official. In New York the Metropolitan Traction Company is taking on a considerable portion of the lighting from the new 70,000-H.P. station; this is because the traction engineers have been smarter in anticipating the great demand than the lighting engineers. It frequently happens that the traction engineer has an advantage in this direction, since on account of the traction undertakings being generally successful the capitalist gives the traction engineer almost unlimited latitude in the design of the plant, and it is easier to predetermine what the maximum demand will be in a traction than in a lighting station.

To summarise, he is of the opinion that lighting and traction installations should be separate and distinct, but that traction installations in the case of municipal undertakings should be so designed as to be capable of augmenting and working with lighting installations in the case of emergency or lack of foresight on the part of the lighting engineer to provide the necessary amount of power.

Perhaps, however, in spite of his strong views on the general question, the authority from whom we quote would admit that in the case of small towns, where neither the lighting nor the traction undertaking is of sufficient magnitude to fully occupy two engineers, and where both are owned by a municipality which is less concerned with actual profits than with the welfare of the community, it would be advantageous to combine the two.

The Röntgen Society.—In his presidential address to the Röntgen Society, Mr. Wilson Noble pointed out that the greatest recent advance in Röntgen ray work was the practical realisation of stereoscopic radioscopy, the allusion, no doubt, being to Mr. Mackenzie Davidson's highly successful instrument, exhibited at the last conversazione of the Royal Society and already noticed in our columns. Mr. Noble said there were many things difficult to see, or, at any events, to distinguish with certainty when seen as a flat surface, but which came out with wonderful clearness when seen on a flat surface. One had only to look at an ordinary stereoscopic slide, first without and then with the stereoscope, to appreciate this. The same holds with the Röntgen ray stereoscope; more particularly was this the case with objects showing but little contrast and ill defined, such, for instance, as the early patches of tuberculosis in the lung. He could not but think that diagnosis of this disease would be enormously facilitated when visual stereoscopic radiography became general. Mr. Noble said that one noticeable feature

of the present practice was the adoption of the influence machine by many workers. It should not, however, be forgotten that though the influence machine is excellent for screen work, it involves too long exposures to hope, in its present inefficient state, to compete with the induction coil in photography. Mr. Noble said that the Röntgen rays had done admirable service on the battlefield and in the hospitals in South Africa, notwithstanding the great practical difficulties that had to be overcome in keeping tubes efficient, in conveying and charging accumulators, &c. Minor advances had been made during the past year in the way of shortening exposures and improving definition.

Fire.—A fire which occurred at the British Insulated Wire Works at Prescot late on Tuesday night was of a comparatively trivial nature. A drum of cable in the drying oven caught fire, and was quickly extinguished by the company's own fire brigade. The damage done to buildings was almost negligible, but a good many drums of cable in course of manufacture were spoiled by smoke and water. The whole factory was working as usual the next morning, and no inconvenience will be caused to customers, except those for whom the damaged cables were being built, and in this case it will only mean a few days' delay.

The Western Smoke Consumer and Fuel Economiser.—This "patent" is being offered to the public for £30,000. Less than 12 lines of the prospectus are given to the description of the invention, which is one for admitting heated air to prevent smoke in furnaces. We see no reason why, if properly arranged, the appliance should not be successful, because we did the same thing 30 years ago, and our device is covered by the description of this one. What we do doubt is the value of any patent for smoke prevention. The principles have long been known, and only practice has been lacking, and in the prospectus before us we see nothing that will render this special "patent" any better than scores of other smoke preventers. The heating of the air is correct but not new, and we should expect to be able to infringe on this patent simply by adopting some old and lapsed patent. Why is so meagre a description given and no illustration? The apparatus is claimed to be successful at Windsor Castle, but success does not necessarily spell validity of patent.

Appointments Vacant.—A borough electrical engineer is wanted for Darlington. See "Official Notices" to-day.

A chief lecturer in electrical engineering is wanted for the Salford Royal Technical Institute, at £250 per annum. A clerk of works is wanted for the electric light station at Leyton. The Bolton Corporation want an electrical engineer for their electricity undertaking, at a salary of £500 per annum, rising by increments of £50 to £700. See "Official Notices" to-day.

A destructor superintendent, chief clerk, and three engineers are wanted for the Fulham electricity undertaking. See "Official Notices" this week.

The Electrical Volunteers.—From various reports which have come to hand it seems that the Electrical Engineer Volunteers are doing good service in South Africa. A list of additional casualties at Roodeval, June 7th, says that Sapper Charlton (electrical engineer) has escaped near Reitz, and is at Kroonstad. Sergeant Hugh and about 30 sappers are reported to have been taken prisoners.

Lightning Mishaps.—A Bremen sailing vessel was lying in the Thames Haven unloading a cargo of 5,000 barrels of naphtha last week when a heavy thunderstorm came on. It appears that some of the crew who were in the main hold preparing barrels of naphtha for transmission to the shore, were struck by lightning. Three of the men were killed and two burned and injured. The lightning ignited the fumes of naphtha in the hold and an explosion followed. A fire resulted in the lower deck, and the vessel had to be towed out of reach of the wharf.

The new chimney shaft erecting at the Leyton electricity works was struck by lightning on 6th inst., and a certain amount of damage done to the structure.

Marriage.—Mr. W. C. P. Tapper, the chief electrical engineer to the Whitechapel Board of Works, was married at Brighton on Saturday last to Miss Emily Maud Stafford, second daughter of the Mayor of Brighton. The ceremony was performed at the Norfolk Road Wesleyan Church. The list of invited guests and the numerous presents appears in the *Sussex Daily News* for Monday last. The Brighton Corporation and Corporation officials presented a silver tea and coffee service. Mr. and Mrs. Tapper have our hearty good wishes.

NEW COMPANIES REGISTERED.

Electro-Magnetic Traction Company, Limited (66,397).—This company was registered on June 27th, with a capital of £1,500 in £1 shares, to adopt an agreement with H. Lane and W. Griffiths, and to carry on the business of electricians, electrical and mechanical engineers, and any business connected with electro-magnetic and electric tramway and light railway traction. The first subscribers (each with one share) are:—W. Bowles, 101, Raleigh Road, N., gentleman; W. Webb, 39, New Broad Street, E.C., solicitor; C. J. Bridge, 6, Cannonbury Square, N., gentleman; P. Williams, 39, New Broad Street, E.C., gentleman; H. W. Webb, 2, Coningsby Road, N., solicitor; S. Kempson, 53, Princess May Road, N., gentleman; and W. W. Webb, 166, Church Street, N., solicitor. Table "A" mainly applies.

South Lancashire Electric Supply Company, Limited (66,419).—This company was registered on June 29th, with a capital of £10,000 in £1 shares, to carry on in South Lancashire or elsewhere the business of electricians, suppliers of electricity for the purposes of light, heat, motive power and otherwise, manufacturers of cables, wires, lines, accumulators, lamps and appliances, &c. The first subscribers (each with one share) are:—J. Atherton, Hurst Park, Prescot, Lancashire, manufacturer; W. M. M. Forwood, 15, Union Court, Castle Street, Liverpool, solicitor; F. Horne, 44, Loughboro' Park, S.W., secretary; G. T. R. Collis, 3, Lewisham Park, S.E., traveller; H. Perry, 26, St. Mary's Square, S.E., book-keeper; D. Gayler, 11, Ferndale Road, Clapham, S.W., traveller; and A. Purnell, 25, Carlingford Road, N.W., picture dealer. The number of directors is not to be less than two nor more than seven. The subscribers are to appoint the first.

Doe Portable Electric Light and Power Syndicate, Limited (66,482).—This company was registered on July 3rd, with a capital of £40,000 in £1 shares, to adopt an agreement with a company of the same name for the acquisition of certain inventions relating to galvanic batteries, and to carry on the business of electrical engineers, electricians, suppliers of electricity, &c. The first subscribers (each with one share) are:—J. E. Ward, 122, Cannon Street, E.C., chartered accountant; D. R. Galloway, 122, Cannon Street, E.C., articled clerk; Mrs. M. Ward, Montrose, Queenswood Road, Moseley; J. W. Watson, 122, Cannon Street, E.C., engineer; F. W. Scott, 122, Cannon Street, E.C., clerk; P. M. Ainger, Maude Cottage, Pellatt Grove, Wood Green, N., clerk; and G. Franks, 4, Great Winchester Street, E.C. The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first; qualification, £250; remuneration two guineas each per board meeting attended.

Middlesex and Hereford Electric Lighting and Power Company, Limited (66,448).—This company was registered on June 30th, with a capital of £100 in £1 shares, to carry on the business of an electric light and power company in all its branches. The first subscribers (each with one share) are:—D. J. Robertson, 15, Kelross Road, N., gentleman; V. B. D. Cooper, Broadway House, Westminster, civil and electrical engineer; F. H. E. Shipton, Broadway House, Westminster, Lieut. R.N.; M. N. Ridley, 11, Dartmouth Street, S.W., civil engineer; F. O. Smith, 81, Cambridge Gardens, W., M.R.C.S.; C. Crawshaw, 172, Albion Road, Stoke Newington, surveyor; and A. Toch, 14, South Street, Finsbury, E.C., architect. Registered without articles of association.

Improved Electric Glow Lamp Company, Limited (66,465).—This company was registered on July 2nd, with a capital of £40,000 in £1 shares, to carry on the business of electrical engineers, electroplaters, and manufacturers of, and dealers in, electric lamps, fittings, plant, outfits, tools, and apparatus, and in particular to acquire from a company of the same name its business, inventions, designs, &c. The first subscribers (each with one share) are:—W. T. Key, Burnham, Rushey Green, Catford, gentleman; Miss E. M. Roberts, 20, Alkham Road, Stoke Newington; G. H. Speer, 392, Hackney Road, N.E., clerk; C. H. Sims, 103, Endlesham Road, S.W., clerk; L. Boorer, 35, Farley Road, Catford, clerk; A. E. Tester, 12, Ion Road, Thornton Heath, clerk; and A. C. Parker, Portmore Park, Weybridge, clerk. The number of directors is not to be less than three nor more than seven; the first are F. L. Gardner, F. H. Bowman, H. N. Tennant, and A. Gaskell; qualification, 50 shares.

Sandycroft Foundry Company, Limited (66,499).—This company was registered on July 4th, with a capital of £32,000 in £1 shares, to acquire the business carried on at Hawarden, Flint,

and elsewhere, by the Sandycroft Foundry and Engine Works Company, Limited, and to carry on the business of electrical engineers, iron and brassfounders, shipbuilders, &c. The first subscribers (each with one share) are:—E. S. Taylor, Sandycroft, Chester, engineer; F. Taylor, Sandycroft, Chester, engineer; F. H. Williams, 29, Croham Road, South Croydon, secretary; W. L. Bayley, 384, Stanstead Road, Catford, S.E., secretary; F. A. Kingsbury, 34, Amesbury Avenue, Streatham Hill, S.E., clerk; J. H. Wood, 116, Manor Road, Stamford Hill, clerk; and J. W. Churton, Edgeley, Whitchurch, Salop, solicitor. F. Taylor is the first manager. Registered office, 6, Queen Street Place, E.C.

SUPPLY STATION ACCOUNTS.

Hammersmith Vestry Electricity Accounts.

The elected auditors of the Hammersmith Vestry, in their certificate, say that the electric lighting accounts prove the very satisfactory progress made in the undertaking during the past year. Taking the average capital during the year 1899 as £80,000, the chairman of the Electricity Committee, in his report, shows that on this capital the profits would have enabled a company to pay a dividend of 7 per cent., but after repaying capital, and providing interest, the net profit amounts to 2 per cent.

GENERAL STATEMENT.

	1898.	1899.	Increase.
Total capital expenditure ...	£72,426	£104,498	£32,072
Number of units sold	517,629	891,301	373,672
Maximum load in KW.	501	700	199
Gross revenue	£9,438	£13,659	£4,221
Gross profit	£3,739	£5,894	£2,155
Average price per unit sold ...	4·23d.	3·66d.	– ·57d.

There has been a desire to discontinue the use of the demand indicator system. This seems a very illogical move, and we cannot but think that the engineer should point out that the average price will be reduced most rapidly if the demand principle be retained. As it is, the average receipts per unit have fallen more than ½d., the price being very low for London supply.

REVENUE STATEMENT.

	1898. Gross.	1898. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Sale of energy	£9,129	4·23d.	£13,569	3·66d.	– ·57d.
Meter rents	...	...	...	...	...
Sale of apparatus and attending private lamps.	94	·04d.	73	·02d.	– ·02d.
Penalties under contract ..	215	·10d.	...	...	– ·10d.
Interest on outlay for machinery on hire.	...	...	17	·00d.	– ·00d.
Gross revenue ...	£9,438	4·37d.	£13,659	3·68d.	– ·69d.

The total costs have fallen by almost exactly the same amount as the average price per unit has been reduced. Works cost of under 1¾d., and total costs of just over 2d. are very satisfactory for a London station of less than 900,000 units output. The consumers now number 464 with 26,365 8-C.P. lamps, or equivalent connected. Public lighting represents 150 lamps, charged at £22 10s. per annum each.

COST OF PRODUCTION.

	1898. Gross.	1898. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Coal	£2,207	1·02d.	£2,918	·78d.	– ·24d.
Oil, waste, water and engine room stores	621	·29d.	818	·22d.	– ·07d.
Salaries and wages incurred in generation and distribution and attending public lamps.	1,399	·65d.	1,588	·43d.	– ·22d.
Repairs and maintenance of buildings, engines, boilers, dynamos and street lamps	235	·11d.	735	·20d.	+ ·09d.
Works costs ...	£4,462	2·07d.	£6,059	1·63d.	– ·44d.
Rent, rates and taxes ..	499	·23d.	560	·15d.	– ·08d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	360	·17d.	664	·18d.	+ ·01d.
General establishment charges, stationery and printing, law charges and insurance.	378	·17d.	482	·13d.	– ·04d.
Other expenses	...	...	...	...	...
Total costs ...	£5,699	2·64d.	£7,765	2·09d.	– ·55d.

Notwithstanding reductions in price and the fact that a large proportion of the consumers now coming on are small flats, a net revenue of over £1,600 has been made, being nearly £200 more in 1899 than in 1898. We are glad to see that it is intended to form a renewal fund or depreciation account; a matter too often overlooked.

PROFIT STATEMENT.

	1898.	1899.
Interest on loans	£1,370	£2,525
Sinking fund for repayments	949	1,754
Net profit carried forward	1,420	1,615
Gross profit	£3,739	£5,894

Croydon Corporation Electricity Accounts.

The accounts of the Croydon Corporation electricity department for last year afford a gratifying indication of the progress the business is making. The station started in a small way, but on sound lines, and is rapidly growing, nearly £29,000 being spent on extensions during last year, while an increase of over 50 per cent. in the load, and over 66 per cent. in the output testify to the scope which exists for future increases.

GENERAL STATEMENT.

	1898.	1899.	Increase.
Total capital expenditure ...	£88,561	£117,385	£28,824
Number of units sold	451,664	781,291	329,627
Number of lamps (30-watt) connected	31,432	45,122	13,690
Maximum load in kilowatts ...	472	714	242
Gross revenue	£9,407	£13,468	£4,061
Gross profit	£5,353	£6,717	£1,364
Average price per unit sold ...	4·89d.	3·96d.	– ·93d.

The gross revenue has increased by over £4,000, and this has been attained with a large reduction, approaching 1d. per unit, in the average price received. The unusual item in the revenue statement is a payment by the British Thomson-Houston Company "Excess of coal used owing to non-delivery of alternator."

REVENUE STATEMENT.

	1898.* Gross.	1898.* Per unit.	1899. Gross.	1899. Per unit.	Increase.
Sale of energy*	£9,204	4·89d.	£12,884	3·96d.	– ·93d.
Meter rents, &c.	203	·11d.	341	·11d.	·00d.
Supply of coal paid for by British Thomson-Houston Company.	...	...	233	·07d.	+ ·07d.
Sundry fees, &c.	...	...	10	·00d.	·00d.
Gross revenue ...	£9,407	5·00d.	£13,468	4·14d.	– ·86d.

* Average price obtained: For private lighting 4·63d., and for public lighting 2·18d.

The following figures are of interest:—

	Units sold. Units generated.	Efficiency of distribution.	Units generated.	Units. Public lighting.	Units. Private supply.	No. of public arc lamps.
1898 ...	72·9%	83·8%	619,849	110,947	340,717	63
1899 ...	76·0%	80·3%	1,026,679	223,344	557,947	130

Total costs show a small but appreciable reduction. Excluding costs purely incidental to public lighting, and crediting the coal paid for by the British Thomson-Houston Company, Mr. Minshall, the engineer, figures out the total cost at 1·87d. per unit sold, and claims this to be a fair one for an alternating station, with a day load less than 3 per cent. of the maximum, and with a most extensive area of mains. He considers that the figure of only ·98d. (omitting the coal item)—which is lower than any other town, with the exception of Edinburgh and Nottingham—is good for a station in its third year of working. The efficiency of distribution, which he gives as 80·3 per cent., is due to the fact of the transformers being partly switched off during day time. The pounds of coal per unit generated during the year work out at only 5·37.

COST OF PRODUCTION.

	1898. Gross.	1898. Per unit.	1899. Gross.	1899. Per unit.	Increase.
Coal	£1,721	·91d.	£3,145	·96d.	+ ·05d.
Oil, waste, water and engine room stores.	170	·09d.	322	·10d.	+ ·01d.
Salaries and wages incurred in generation and distribution, and attending public lamps.	862	·46d.	1,253	·39d.	– ·07d
Repairs and maintenance of buildings, engines, boilers, dynamos, &c., and street lamps.	142	·08d.	451	·14d.	+ ·06d.
Works costs	£2,895	1·54d.	£5,171	1·59d.	+ ·05d.
Rent, rates and taxes ..	160	·08d.	205	·06d.	– ·02d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	688	·37d.	967	·30d.	– ·07d.
General establishment charges, stationery and printing, law charges and insurance	311	·16d.	408	·12d.	– ·04d.
Other expenses	...	...	...	...	...
Total costs ...	£4,054	2·15d.	£6,751	2·07d.	– ·08

The net profit has reached a figure of not far short of £1,000. The increases in amount allocated to interest and sinking fund charges,

and to surplus or net profit, are practically equal, being about £680 in each case. The addition of a traction load, the plant for which in now on order, should augment the profit considerably.

PROFIT STATEMENT.

	1898.	1899.
Interest on loans .. .. Sinking fund for repayments	£4,092	£3,014 2,762
Payment to British Thomson-Houston Co.	1,000	...
Net profit carried forward	1261	941
Gross profit	£5,353	£6,717

CITY NOTES.

City of London Electric Lighting Company.

AN extraordinary general meeting of the City of London Electric Lighting Company, Limited, was held on Wednesday at Winchester House, Sir David Salomons, Bart., taking the chair. The meeting was called for the purpose of authorising the directors to borrow not more than £400,000 in excess of the debenture stock of the company.

The CHAIRMAN observed that at the last general meeting he announced that it was the intention of the board to issue the remaining 20,000 ordinary shares of the additional capital which the shareholders had authorised a year previously. He had also pointed out that the board had been forced to spend on capital account a large amount of the revenue earned in the previous year. This would have been replaced if the issue of the shares had proved successful, but only half of the shares had been taken up, and of these the directors had taken more than their proportion, so that at least ought to help in giving confidence to the shareholders. It was absolutely essential that more capital should be found to meet the outstanding liabilities on capital account, and to deal with the increasing business, otherwise the company could not continue its operations. The market had been greatly disorganised, and the ordinary shares stood at a small discount. The directors believed, notwithstanding that the company was a good property, but recognising that it was not possible to issue the remaining 10,000 shares at par, and they could not be issued at a discount, some other way must be found of raising the capital required. They therefore recommended the shareholders to increase the borrowing powers of the board, as being the most economical and prudent course. It must be left to the board to exercise these powers from time to time as they might deem expedient. Whether second debentures, temporary loans, or any other method of raising the money would be adopted must depend upon market considerations. The shareholders would no doubt see the wisdom of adopting the recommendation now made by the board, and would give the necessary authority. The directors would only borrow such money from time to time as might be required, and would place the remaining ordinary shares as soon as the situation would admit. He might mention that the company's Bill, which would give increased facilities to the company, and would be of great advantage, had received the Royal assent. He concluded by moving a resolution giving the board the required power.

Mr. G. HERRING seconded the motion.

Mr. BOYLE, Q.C., said that, according to the statement of the chairman, £100,000 worth of the shares had been placed, and it would seem that the board made the fact that the other £100,000 had not been placed an excuse for asking for £400,000, or four times the deficit. That was a little startling. Did they wonder that the shareholders were a little anxious about their property, and did they think it was treating them fairly, liberally and justly, to serve them with a notice to this effect, which some of them had only received four days ago, and to rush through in this way power to expend something very little short of half a million of their money? He was a holder of between £3,000 and £4,000 worth of the 6 per cent. preference shares, and this would be putting before their dividend £400,000. A considerable number of the shareholders were trustees, who would not be able to act on the short notice which had been given, and a very large number were widows or spinsters. It was, therefore, not an unreasonable request on the part of the preference shareholders to ask that the meeting should be adjourned for a fortnight, so that a committee so largely interested as the gentlemen who were acting with him might have the opportunity of conferring with the board. He knew the board, by means of the proxies, could carry anything they wished, but he asked whether that was fair to the preference shareholders. He moved as an amendment that the question was so important, that its consideration should be adjourned for a fortnight.

Mr. T. J. JACKSON seconded.

The CHAIRMAN, in answer to shareholders, said the board had only at present borrowing powers up to a given figure. They wanted the shareholders to give borrowing power beyond the £400,000 of debentures to the extent of £400,000. The money could not be first debentures. He could not tell what it would be. He was a preference shareholder, but being behind the scenes, he could see the matter in a different light from Mr. Boyle. The company would require money probably before the end of the year for orders already issued, partly for money already borrowed to pay contractors and for land which had been bought. Under the Act they now had they would be able to complete their stations and certain land which had to be purchased compulsorily. There would be the sum of a quarter of a million on capital account this year for increasing their works. The company were under Parliamentary obligation to supply, and they must meet that obligation, or what would be their position? They had been obliged to take certain moneys out of revenue in order to keep pace with the demands made by the extension of the business. The unfair treatment they had received on the part of the City of London had no doubt affected the value of the shares very greatly; but that could not be helped. The demand for electric energy increased day by day, and it was absolutely necessary the works should be carried out. It would not be practicable to issue second debentures or second preference shares. Every year provision had to be made for 60,000 new lights; during the last week or 10 days 3,000 lights had been applied for. As a result of the Act of this year a quarter of a million would be required on capital account to keep the concern going and to keep pace with the demand.

Mr. HERRING pointed out that the money was required because the business was improving.

The CHAIRMAN said the gross increase during the last quarter was £7,500. That was on the new tariff of 8d. and 2d., compared with 7d. of last year. That showed the company was not doing badly.

The amendment was negatived on a show of hands, and the motion was then adopted.

The notice calling the meeting was accompanied by the following circular:—

Your directors have decided to call a meeting of the shareholders in order to obtain their sanction to enlarge the borrowing powers of the board. The formal notice convening the meeting is annexed hereto.

This increase of borrowing power is required to meet the present and future expenditure on capital account, rendered necessary by the continually increasing business of the company.

The business of the company continues to progress satisfactorily, as will be seen by the following statement:—

NUMBER OF CUSTOMERS AND LAMPS CONNECTED
(after allowing for disconnections on account of removals, &c.).

—	Dec. 31, 1896.	Dec. 31, 1897.	Dec. 31, 1898.	Dec. 31, 1899.	June 20, 1900.*
Number of customers being supplied	5,803	6,822	7,414	8,788	9,121
Number (equivalent) of 8-c.p. lamps connected	247,785	296,012	355,825	419,628	466,852

* The corresponding figures on June 21st, 1899, were 7,878 customers and 388,512 lamps.

On June 20th, 1900, there were in addition 15,559 lamps awaiting connection, on completion of the consumers' wiring, &c.

The demand for power for driving machinery, &c., is greatly increasing.

As foreshadowed at the ordinary general meeting held in March last, your directors, after giving most anxious consideration to the question of the rate of charge to consumers, have adopted a method of charging which they have every reason to believe will result in a substantial increase to the revenue of the company.

Your board were successful in their action to establish the validity of the contracts entered into by the Corporation of London. The Corporation have given notice of appeal, but it is not probable that the appeal will come on for hearing until after the long vacation.

The Bill for the purpose of relieving the company of the statutory obligation to set aside annually a fixed percentage of money for depreciation and reserve, and providing for the compulsory acquisition of certain properties required for the extension of the Bankside works, has passed the Committee stage in both Houses of Parliament.

The British Continental Electricity Company. Limited.

THE annual meeting of this company is to be held to-day at 82, Victoria Street, S.W., at 12 o'clock. The directors' report reads as follows:—

The directors have pleasure in submitting a statement of the accounts, as certified by the company's auditors, together with a report of the position of the undertaking at the end of the year 1899-1900. During the year 67 applications have been received for electric light, while the number of lamps added during this period, calculated on the usual basis of 8 c.p., has been 3,189, as against 3,150 for the preceding year. Notwithstanding further reductions made in the price of light, the gross receipts from sale of current show an increase of 70 per cent. over those of last year, while the net receipts have increased from £191 6s. to £805 2s. 6d. The directors regret that, owing to the still further rise in the price of coal, the working expenses have again been exceptionally heavy. They have pleasure in stating, however, that, owing to economies which have been made in the working, the coal consumption has been materially reduced. After setting aside £33 1s. 8d. as depreciation in respect of furniture, tools, and meters, making a reserve of £20 for bad debts, and writing off £60 from preliminary expenses, the balance standing to the credit of revenue account is £805 2s. 6d. Of the above balance £227 5s. 9d. has been absorbed in the payment of the interim dividend at the rate of 5½ per cent. per annum on the cumulative preference shares, leaving a balance of £577 16s. 9d. now to be dealt with. The directors recommend that the above sum be appropriated as follows:—

1. By payment of a dividend at the rate of 2½ per cent. per annum on the cumulative preference shares for the six months ending April 30th, 1899, being the balance of the dividend owing on these shares to that date	£102 18 4
2. By payment of a dividend at the rate of 5½ per cent per annum on the cumulative preference shares for the past half-year, making, with the interim dividend paid in January, the full dividend for the year	254 19 6
3. By payment of a dividend at the rate of 2 per cent. per annum for the past half-year on the ordinary shares ..	80 5 11
4. Leaving a balance to be carried forward of	139 13 0
	£577 16 9

The directors having decided to consider the purchase price of the San Remo undertaking as a fixed asset in sterling, there is a profit on exchange (owing to a fall in the latter during the year) of £38 2s. 4d. This the directors have taken to a reserve against any loss which might occur in future years owing to fluctuation in the rate of exchange. The sum of £857 0s. 5d. has been spent on capital account during the year, in addition to a deposit of £330 3s. 4d. on new machinery ordered for next season. Nothing has been written off the San Remo purchase account, as the directors consider that the goodwill comprised therein has materially increased in value during the year. The amount received as premiums on shares has been set aside to form the nucleus of a

reserve fund. In accordance with the articles of association, Mr. C. H. C. Woodhouse retires from his directorship, and being eligible, offers himself for re-election. The auditors, Messrs. Hercules Nicol & Barker, also retire, and being eligible, offer themselves for re-election.

Edmundson's Electricity Corporation, Limited.

The third ordinary general meeting of the shareholders of this corporation was held at the offices of the company, Broad Sanctuary Chambers, Westminster, S.W., on July 6th, Mr. John R. Wigham, J.P. (chairman), presiding.

The Chairman, in moving the adoption of the report, said that in doing so he felt it was his duty to make a few observations, and he thought they would all agree it was a very satisfactory record. They would see that the profit for the year had been £17,250, as against £11,267 last year—a very substantial increase of £6,000. Examining the balance-sheet, they would see that the capital during the year had been increased by the issue of 9,400 ordinary shares, making the total capital £200,000, which was the full amount at present authorised. There had been also small further issue of debentures, making the total of debentures £75,000. Among the assets they would notice a large item of £121,000—sundry debtors and advances to subsidiary companies. The advance to subsidiary companies, which formed a large proportion of that item, represented money spent in connection with their various companies, in exchange for which they were entitled to get shares or debentures. Since the date of the balance-sheet that item had been very considerably reduced by the transfer to the company of many of these shares and debentures. There was another large item on that side—investments at cost—£111,000. That represented shares and debentures which they held in their various companies, and these had all been taken at their actual cost to the corporation, their par value being considerably larger. That difference was an asset, which, when realised, would be available for dividend, and was a very important item in estimating the position of the company, although it was not visible at all in the balance-sheet. The directors recommend a dividend of 6 per cent. on the ordinary shares and on the deferred shares, and proposed to write £5,000 off the goodwill, and to carry forward the sum of £4,152 to the next account. The fact of their writing off £5,000 goodwill did not mean that the value of the goodwill had decreased, but the directors thought it was good policy to gradually reduce that item. The progress which their various stations had been making during the year would be seen from the schedule sent out with the balance-sheet. In nearly every case the progress had been beyond their expectations. The use of electric energy for all purposes was daily becoming more and more a necessity of modern life, and their company was reaping the benefit. That rapid increase had necessitated large extensions in the towns which the corporation had in hand, and most of their work during the past year had been directed to such extensions, and only a few *new* works had been commenced. They had, however, been able to secure powers for several other important towns, which were being confirmed in this session of Parliament. Amongst these were Grantham, Stamford, Twickenham, Bishop Auckland, Weybridge, and Redruth. At the last annual meeting it was suggested by a shareholder that the directors should not lose sight of the value of electric traction in connection with their lighting stations. The directors had not lost sight of that, and they had practically secured a valuable concession for an electric tramway between Redruth and Camborne, which they propose to work in connection with their Redruth central lighting station. A considerable number of private installations for country houses, &c., had been carried out during the year, and others were in course of construction, this branch of their business having been well maintained. Such installations and other works had been carried out for the following among other customers:—The Right Hon. the Earl Cowley, the Right Hon. the Earl of Harrowby, the Right Hon. the Earl of Shaftesbury, the Right Hon. Lord Brassey, the Right Hon. Lord Iveagh, Sir Savile Crossley, Bart.; W. Gazelet, Esq.; C. J. Fletcher, Esq.; A. E. Foley, Esq. As was the case last year, additional capital is required to meet their extending business, and the directors proposed that the capital of the company should be increased from £200,000 to £400,000, and they proposed that £100,000 be issued at once as 6 per cent. preference capital, reserving the remainder for issue when required. The directors thought that it was in the interest of the ordinary shareholders that preference shares should be issued instead of increasing the ordinary share capital. By limiting the dividend to 6 per cent. on the new capital, the present ordinary shareholders would receive the entire advantage of the larger dividends, which might reasonably be expected. As they had two classes of shareholders—ordinary and deferred—formal meetings of each class had been called to take place at the close of that meeting, in order to confirm the resolutions for the increase of capital.

Mr. W. R. Davies seconded the motion.

Mr. Powell said the Chairman had stated that they might look for increased profits in the future. He was rather hoping, looking at the fact that on August 8th of last year when the new shares were issued, the directors reported that there was every indication of a further improvement in the current year, that they would get a further dividend of 7½ per cent. this year.

The Chairman said they would increase the dividend as soon as they were in a position to do so. If the accounts were examined, they would seen that they might have paid 10 per cent. this year, but they thought it more prudent to pay a dividend of 6 per cent. and to write £5,000 off goodwill.

The report was then adopted.

The retiring director and the auditors having been re-elected,

The Chairman moved:—

That the capital of the corporation be increased to £400,000 by the creation of 40,000 new shares of £5 each.

Mr. Davies seconded the resolution, which was agreed to, as was the following resolution:—

That 20,000 of such new shares to be called preference shares, and to confer on the holders thereof the right to a fixed cumulative preference dividend of 6 per cent. per annum on the capital for the time being paid up on such shares, and such preference shares to rank both as regards capital and dividend in priority to the other shares.

The Chairman next proposed:—

That the directors be and they are hereby authorised to issue the remaining 20,000 new shares, or such part thereof as they shall think fit, either as preference shares, ranking in all respects *pari passu* with the 6 per cent. preference shares above mentioned, or as ordinary shares of the corporation.

This was seconded by Mr. Davies, and carried.

The resolutions for the increase of capital were subsequently submitted to separate meetings of the ordinary and deferred shareholders and approved.

Calcutta Tramways Company.

The report of the directors for 1899, to be submitted at the meeting to be held in London on 17th inst., states that the accounts show gross receipts, £68,719, expenditure under all heads, £60,689, and a revenue balance of £8,030, which, added to the amount brought forward, gives, after deduction of interest on debentures and loans, a net balance of £25,642. The receipts have been prejudicially affected, to the extent of about £7,500, by the reconstruction of the lines, which has been in operation throughout the year, and of which little now remains to be done. On the other hand, considerable savings in expenditure have been made, so that the net result is only £2,650 less than that of the previous year. The last report contained particulars of the agreement entered into with the Corporation, and stated that preliminary surveys were being made with the object of concluding a definite contract for the electrical equipment of the lines. This contract has now been concluded with Messrs. Dick, Kerr & Co. for a sum not to exceed £170,000, for the electrical requirements of the system other than the necessary buildings. The last report also stated that the directors proposed to create an issue of £350,000 of 4½ per cent. first debentures for the purposes therein stated. An issue of 4½ per cent. debenture stock was accordingly created, and £250,000 was offered for public subscription on March 26th last. The subscriptions were very satisfactory, and the company is now in possession of ample funds for its present needs. Since active measures have been taken for the conversion of the lines, numerous applications have been made to the company by the authorities in Calcutta for extensions in various directions. These applications are receiving careful consideration, and it is probable that many of them will prove of great value to the public and profitable to the company.

Official Announcements re Companies.

The following companies will be struck off the register within three months, unless cause is shown to the contrary:—

Battery and Motor Company.
British Association of Medical Electricians.
Canton (Waipori) Mining and Electric Power Company.
Capital and Counties Electric Supply Company.
Capsule Battery Company.
Corbridge Electric Lighting Company.
Cruto Incandescent Lamp Agency.
Devon Traction and Motor Company.
Electric and General Contract Corporation.
Electric Free Wiring Syndicate.
Electric Meter Company.
Electric Racing Horse Maze (Pioneer Syndicate).
Electric Steam Syndicate.
Electrolytic Separation Syndicate.
Eliéson Lamina Accumulator Company.
European Electric Finance Company.
Gravier Dynamo Syndicate.
Improved Incandescent Electric Lamp Syndicate.
Llandudno Electric Supply Company.
London Electrical Carriage Company.
London Electrical Coupé Company.
London Electrical Van Company.
London Health Electrical Institute.
North London Electric Supply Company.
Peerless Accumulator Syndicate.

Stock Exchange Notices.—Applications have been made to the committee to appoint a special settling day in and to grant a quotation to—St. James's and Pall Mall Electric Light Company, Limited.—£159,000 3½ per cent. debenture stock. Westminster Electric Supply Corporation, Limited.—Further issue of 30,100 ordinary shares of £5 each. The committee has further been asked to allow the following securities to be quoted in the Official List:—National Telephone Company, Limited.—£500,000 4 per cent. debenture stock; and a further issue of 100,000 ordinary shares of £5 each, fully paid, Nos. 490,001 to 590,000.

The Direct United States Cable Company, Limited.—The board has resolved to recommend a final dividend of 3s. per share, and a bonus of 2s. per share (both free of income-tax); such dividend and bonus to be payable on and after the 31st inst., making with the three interim dividends paid a total distribution of 3½ per cent. for the year ended June 30th last, and after placing

£10,000 to reserve fund account, carrying forward a balance of about £3,700. The transfer books will be closed from July 10th to 24th.

The Isle of Man Tramways Company.—In the Manx Chancery Court on Wednesday, a petition for a compulsory liquidation order against the Isle of Man Tramways and Electric Power Company, Limited, came on by adjournment. The order was not further objected to by the new board of directors, who had been unable to make arrangements to place the company in a satisfactory financial position. Mr. W. H. Walker was appointed as liquidator.

Prospectuses.—The United River Plate Telephone Company has this week been offering an issue of 23,361 5 per cent. £5 preference shares for subscription. The reason for this issue is stated in our report last week of the company's meeting. The list was to close on Wednesday.

Letters of allotment and regret in R. Waygood & Co. have been posted. The issue was largely over applied for.

The Rand Central Electric Works, Limited.—The sixth ordinary general meeting of shareholders will be held at Winchester House, E.C., on Tuesday, July 31st, 1900, at 12 o'clock, noon, to receive the directors' reports to December 31st, 1899.

Globe Telegraph and Trust Company.—The directors announce a dividend of 4s. 6d. per share on the ordinary shares, making, with the previous distributions, a total dividend for the year of 5¼ per cent., carrying forward about £950.

Crompton & Co.—The directors recommend a dividend at the rate of 9 per cent. per annum for the half-year, making, with the interim dividend paid in January, 7½ per cent. for the year, £12,000 being added to the reserve fund.

The City of London Electric Lighting Company, Limited.—Warrants for payment of interest on £400,000 5 per cent. debenture stock for the half-year ended June 30th, 1900, have been duly posted.

Eastern Extension Telegraph Company.—The directors have declared an interim dividend for the quarter ended March 31st of 2s. 6d. per share, payable 14th inst.

Telegraph Construction and Maintenance Company, Limited.—An interim dividend of 12s. per share is announced.

Cape Electric Tramways Company.—The directors have declared an interim dividend of 5 per cent.

TRAFFIC RECEIPTS.

The Blackpool and Fleetwood Tramroad Company.—The receipts for the week ending July 7th, 1900, were £801 8s. 8d.; receipts for corresponding period, 1899 (8 days), £1,048 5s. 7d.; aggregate for half-year to date, £801 8s. 8d.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending July 6th, 1900, were £3,221 15s. 7d.; corresponding period, 1899, £3,153 11s. 4d.; increase, £68 4s. 3d.

The City and South London Railway Company.—The receipts for the week ending July 8th, 1900, £1,447; July 9th, 1899, £1,037; increase, £410. Total receipts for half-year, 1900, to date, £1,447; corresponding period, 1899, £1,037; increase, £410. Miles open, 1900, 4¾; 1899, 3¾.

The Cork Electric Tramways and Lighting Company, Limited.—The receipts for the week ending Thursday, July 5th, 1900, were £526 2s. 6d.; corresponding week last year, £439 7s. 11d.; increase, £86 14s. 6d. Total to July 5th, 1900, £10,073 11s. 0d.; corresponding period last year, £8,931 1s. 0d.; increase, £1,142 10s. 0d.

The Dover Corporation Tramways.—The receipts for the week ending, July 7th, 1900, were £285 16s. 7d.; July 8th, 1899, £219 10s. 2d.; increase, £16 5s. 5d. Total receipts to date, 1900, £4,737 5s. 4½d.; corresponding period 1899, £4,451 8s. 6d.; increase, £285 16s. 8½d. Miles of track open, 1900, 3; 1899, 3. Car miles run, 1900, 5,007; 1899, 4,510. Number of cars, 1900, 11; 1899, 11.

The Dublin United Tramways Company.—The receipts for the week ending Friday, July 6th, 1900, were as follows:—D. U. T. Co., horse cars, £41 18s. 6d.; ditto, electric cars, £3,107 14s. 0d.; D. S. D. Co., electric cars, £247 3s. 4d.; total, £3,996 15s. 10d; corresponding week last year—D. U. T. Co., horse cars, £1,742 9s. 10d.; ditto, electric cars, £1,063 0s. 9d.; D. S. D. Co., electric cars, £877 5s. 8d.; total, £3,682 16s. 3d.; increase, £313 19s. 7d. The mileage worked is 42 miles electrically, 2 miles by horses, as against 18 miles electrically, 26 miles by horses, for the corresponding period last year.

The Halifax Corporation Tramways.—The receipts for the week ending July 2nd, 1900 were £900; week ending July 1st, 1899, £670; increase, £230. Total receipts to date, 1900, £9,615; ditto, 1899, 6,786; increase, £2,829. Miles of track open, 1900, 14; 1899, 6½. Number of cars, 1900, 29; 1899, 14.

The Liverpool Overhead Railway Company.—The receipts for the week ending July 8th, 1900, were £1,687; corresponding week last year, £1,539; increase, £148.

STOCKS AND SHARES.

Wednesday Evening.

The tension caused by the Chinese situation has perceptibly slackened this week in the Stock Exchange. Grave though the position is, investors are beginning to realise that it may not be as bad as was feared at first, and some of the bolder spirits are taking advantage of the existent weakness in the investment markets to pick up cheap stock. The money market is fairly easy, although it exhibits restless signs of becoming harder, which we think are not likely to attain fruition for the next three months at all events. In South Africa the campaign is undoubtedly drawing to a close. Speaking generally, the outlook for markets is all in favour of better prices whenever a little more interest is manifested in stocks and shares by the outside world.

Very little trade is passing in Electrical Supply shares. The market has been quieter this week than for several months, perhaps because there is now no particular excitement to maintain public concern in this department. Metropolitans are retaining their advance of last week, and a Marylebone vestryman in the Stock Exchange tells us that the body to which he belongs is jubilant over the defeat of the would-be competitors. As regards the latter, we should not be astonished to learn that several people connected with the scheme had gone so far as to actually acquire land for the purpose of starting work as soon as Parliament gave the necessary powers. There are probably cheap sellers of that land now.

The meeting between the Notting Hill directors and the Committee on Tuesday produced no effect in the price of the shares, which for some time past have been a peculiarly quiet market. We understand that yet another conclave will be held shortly, and it is evidently not the time to sell the shares.

In order to demonstrate the comparative cheapness of Electrical Supply Ordinary shares at the present time, we submit a short table, showing the highest and lowest prices recorded this year, and adding the current quotations in a third column:—

Company.	1900.		Now.
	Highest.	Lowest.	
Brompton and Kensington...	7⅞	7⅜	7½
Charing Cross	11	8¾	10
City of London	11½	8⅜	9
Chelsea	8¼	6¾	6½
Metropolitan	15¼	13½	15
St. James's and Pall Mall ...	16⅜	14⅜	14
Westminster	16	11¼	12

The Welsbach Company has promised to introduce its electric mantle in the autumn. Something is sadly needed to brighten up the price of Welsbach issues, but if the new patent should prove a failure after all that has been said about it, Welsbach stocks and shares will indeed be in a bad way. As it is, there seems to be an almost certain reconstruction looming ahead of this unfortunate enterprise.

Central London shares are weak, although the price is above the lowest touched since we last wrote. The selling which brought about the drop emanated from Berlin, where the shares are extensively held Our readers would be astonished, could they examine the list of shareholders, to see how much of the company's capital is resting in the Fatherland. The fire at Hoboken seriously disconcerted some of the more unstable of the Berlin financial houses, which threw out all the saleable shares they had in order to stave off a money panic. Central Londons were among those shares. The disappointment regarding the delay in opening the line to the public has operated against any public support being rendered to the market in Throgmorton Street. City and South London is hardly mentioned, but the price of the stock has not got over the effects of the lift accident at London Bridge. Waterloo and City shows no appreciable recovery from its last week's fall.

As was generally anticipated in the market, the Globe Telegraph and Trust Company has declared its final dividend for the year of 4s. 6d. per share, making 5¼ per cent. for the 12 months. The showing is not a bad one, considering the troublous times of the last half-year. The directors' policy is a very conservative one, and therefore, perhaps, the best, although such a Trust Company might reasonably be expected to earn 6 per cent. on the Ordinary share capital.

Traction shares are very quiet. The new British Electric Tractions can be sold at 6s. 6d. for the Ordinary and 4s. for the Preference. The latest issue of Calcutta Electric are quoted at ¼ to ⅜ premium, at which they cannot be considered expensive. Anglo-Argentine Trams are the subject of a strong "bull" tip in the Stock Exchange, but the traffic decrease of £902 for the last week acted as a damper to the optimists.

In the telegraph department, Eastern Extensions—"Chinas," as they are colloquially called—are very steady at 15, and it is understood that the company is doing exceedingly well over the Far Eastern crisis. As the directors are more likely to put the extra profits to the reserve fund instead of increasing the dividends, the price of the shares is not likely to advance at present, but as a lock-up investment, "Chinas" will probably pay the buyer handsomely in future. Eastern Ordinary remains at 150, and the public are not buying telegraph securities at present, otherwise the company's position would fairly warrant the price standing 10 per cent. higher. The West Indian shares show no signs of recovering their recent declines.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation, July 4th.	Closing Quotation, July 11th.	Business done during week ended July 11th, 1900. Highest.	Lowest.
110,900	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
125,000	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red.	100	...	...	...	85 — 90	85 — 90	...	...
875,520	Anglo-American Telegraph	Stock	3 %	£3 9s	73/6	60 — 63	60 — 63	£0	...
3,062,240	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	113½—114½	113½—114½	114½	114
3,062,240	Do. do. Deferred	Stock	...	18s. %	£1 7s	12⅝— 13¼	12¼— 13	12⅛	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	3 %	...	2½— 3½	2½— 3½	...	...
10,000,000$	Commercial Cable	$100	8 %	8 %	...	165 —175 xd	165 —175	...	...
1,563,078£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	101 —103	101 —103	102½	102
16,000	Cuba Telegraph	10	7 %	8 %	7 %	6½— 7½	6½— 7½	7⅛	...
6,000	Do. 10 % Pref.	10	10 %	10 %	...	15½— 16½	15½— 16½	...	...
12,981	Direct Spanish Telegraph	5	4 %	4 %	...	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	...	...	9 — 10	9 — 10	...	...
30,000	Do. do. 4½ % Debs.	50	...	...	...	100 —104¾xd	100 —104¾	...	...
60,710£	Direct United States Cable	20	3½%	3½%	3 %	11½— 12	11½— 12	...	...
111,300	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	99 —102 xd	99 —102	100½	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	148 —153	148 —153	151½	148
1,795,000	Do. 3½ % Pref. Stock	100	...	...	...	97 —100	97 —100	97½	...
1,432,368£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	...	...	111 —116	111 —116	...	...
250,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	14⅜— 15¼	14⅜— 15¼	15	14⅜
6,700£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	...	...	... — ...	... — ...	...	...
26,600£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	...	...	... — ...	... — ...	...	...
820,000£	Do. 4 % Deb. Stock	Stock	4 %	...	...	112 —117	112 —117	...	...
800,000£	Eastern and South African Telegraph, 4 % Mort. Deb., Nos. 1 to 3,000, red. 1909	100	...	...	...	100 —103	100 —103	...	...
200,000£	Do. 4% Reg. Mt. Debs. (Mauritius Sub.) 1—3,000	25	...	...	...	100 —103%	100 —103%	...	...
180,287	Globe Telegraph and Trust	10	4½%	5½%	5½%	11½— 11⅝	11½— 11⅝	11 9/16	11 9/16
180,042	Do. do. 6 % Pref.	10	6 %	6 %	...	15 — 15½	15 — 15½	15½	15 1/16
150,000	Great Northern Telegraph, of Copenhagen	10	10 %	12½%	...	32 — 34	32 — 34	...	...
84,300	Halifax and Bermuda Cable, 4½% 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	98 —101 xd	98 —101	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	53 — 57	52 — 56	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	...	...	105 —108	105 —108	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680	1	...	...	...	¼— ½	¼— ½	...	...
86,492	Do. do. 5% Pref., Nos. 1 to 86,492	1	4 %	4 %	2½%	¾— 1	¾— 1	...	...
490,000	National Telephone, 1 to 490,000	5	6 %	6 %	5 %	5 — 5¼	4⅞ — 5⅛	4 1/16	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 15	13 — 15	13⅜	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	6 %	5 — 5¼	5 — 5¼	5 1/16	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	98 —101 xd	97 —100	99	98
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅞— 1⅛	⅞— 1⅛	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	...	...	100 —103 xd	100 —103	...	...
11,839	Reuter's	8	5 %	5 %	5 %	7½ — 8½	7½ — 8½	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	125 —130	125 —130	126	...
58,000	United River Plate Telephone	5	5 %	6 %	7 %	5 — 5⅛	5 — 5⅛	5⅛	...
16,639	Do. do. 5 % Cum. Pref. Nos. 1—16,689	5	...	...	...	5 — 5¼xd	5 — 5¼	...	...
179,947	Do. do. 5 % Debs.	Stock	...	...	...	104 —107 xd	104 —107	...	...
200,000£	West African Telegraph, 5 % Debs.	100	%	...	...	97 —100	97 —100	99½	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— 1	¼— 1	...	...
150,000	Do. do. 4% Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	99 —102 xd	99 —102	...	...
389,731	Western and Brazilian Telegraph 4 % Deb. Stock Red.	Stock	...	...	...	... — ...	102 —105	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	14⅜— 15¼xd	14⅜— 15½	14⅝	14⅜
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	...	...	...	108 —106	108 —106	...	...
88,321	West India and Panama Telegraph	10	2½ %	2 %	1 %	⅝— ¾	⅝— ¾	¾	9/16
24,563	Do. do. do. 6 % Cum. 1st Pref.	10	6 %	...	...	6½— 7½	6½— 7½	6¾	...
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	6 %	...	...	6 — 7	6 — 7	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	...	...	102 —105 xd	102 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	4 %	6 %	6 %	7 — 8	7 — 8	...	...
12,000	Do. do. 7 % Cum. Pref.	5	7 %	...	...	8¼— 9½	8¼— 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	7 %	8 %	9 %	9½ — 10½	9½ — 10½	...	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	5½— 6	5½— 6	5⅝	...
84,000	*Chelsea Electricity Supply, Ord.,	5	6 %	6 %	6 %	6 — 7	6 — 7	6 7/16	6⅜
150,000	Do. do. do. % Deb. Stock Red.	Stock	4½%	...	...	107 —110	107 —110	109	...
60,000	City of London Electric Lighting, Ord. 40,001—100,000	10	10 %	6 %	4 %	8½ - 9½	8½ - 9½	...	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12½ - 13½	12 — 13	12⅝	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	...	...	122 —127 xd	122 —127	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	nil	nil	4 %	9 — 10	8½ - 9½	9	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	11½ — 12½	11½ — 12½	...	...
200,000	Do. 4½% Deb. Stock, Prov. Certs (all paid) Rd.	...	...	...	...	108 —111 xd	108 — 111	108½	...
26,100	Edmundsons Elec. Corp., Ord. Shares	5	5 %	7 %	...	4½ - 5	4½ - 5	...	...
75,000	Do. do. 4½ % 1st Mort. Deb. Stock	100	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord.	3	...	...	...	1 — 1½	1 — 1½	...	...
49,840	Do. do. do. 6 % Pref.	5	...	6 %	...	4 — 4½	4 — 4½	...	...
250,000	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	98 —100	98 —100	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	6 %	5 %	5 %	14½ - 15½	14½ - 15½	15½	14⅝
220,000£	Do. 4½ % First Mortgage Debenture Stock	...	4½%	...	...	111 —114 xd	111 —114	113	111
220,000	Do. 3½ % Mort. Deb. Stock Red.	Stock	...	...	...	96 — 98 xd	96 — 98	...	...
6,452	Notting Hill Electric Lighting	10	6 %	6 %	7 %	15½ - 16½xd	15½— 16½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14 — 15	13½ - 14½	14⅝	14½
20,000	Do. do. 7 % Pref., 20,001 to 40,000	5	7 %	7 %	7 %	8½ — 9½	8½ — 9½	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2¼	2 - 2¼	...	...
50,000	Do. Do. 4 % Deb.	100	...	...	...	85 — 95	85 - 95	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	3¾ - 4¼	3¾ - 4¼	...	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000	5	12 %	12 %	13 %	11 — 12	12 — 13	11⅞	11½

* Subject to Founders Shares.
‡ Unless otherwise stated all shares are fully paid.
† Quotations on Liverpool Stock Exchange.
‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1897.	1898.	1899.	Closing Quotation July 4th	Closing Quotation July 11th.	Business done week ended July 11th. 1900. Highest.	Lowest.
		‡							
65,000	Aluminium shares, Nos. 1—65,000	1	10 %	20 %	...	2⅜ — 3¼	2⅜ — 3¼	2 1/16	2 1/16
90,000	Do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	96 —101	96 —101	...	...
30,000	British Electric Traction	10	...	6 %	...	14 — 15	14 — 15	14½	14
50,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12½ — 13	12 — 13	12⅞	12 9/16
200,000	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	123 —126	123 —126	124	...
85,000	†British Electric Works Co., Ord. £1 shares, 50,001—135,000	...	...	...	...	⅜ — ⅞	⅞ — 1	...	...
50,000	† Do. do. 6 % Cum. Pref., 1—50,000 ...	...	...	...	...	1 1/16 — 1⅛	1 1/16 — 1⅛	...	...
500	† Do. do. 4½ % 1st Mort. Deb.	100	...	...	...	97 — 99 xd	99 —101	...	...
40,000	British Insulated Wire Ord., Nos. 1 to 40,000	5	15 %	15 %	20 %	11 — 12	11 — 12	...	...
27,500	Do. do. 6 % Cum. Pref. Nos. 1 to 27,500 ...	5	...	...	...	6 — 6¼	6 — 6¼	...	...
90,000	Brush Elecl. Engng., Ord., 1 to 90,000	3	3 %	5 %	...	1⅝ — ⅞	1⅝ — 1⅞	1 11/16	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	6 %	6 %	...	2 — 2¼	2 — 2¼	...	...
125,000	Do. do. 4½ % Perp. Deb. Stock ...	Stock	...	...	...	109 —114	109 —114	...	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red. ...	Stock	...	...	...	101 —103 xd	103 —105	...	...
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	12½ %	15 %	15 %	13½ — 14½	13 — 14	13⅝	...
20,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½ — 5⅝ xd	5½ — 5⅝	...	...
90,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	110 —114 xd	110 —114	...	...
213,533	Central London Railway, Ord. Shares	10	...	...	...	9⅝ — 10 1/16 xd	9½ — 10	10	9⅝
61,033	Do. do. Pref. half-shares	5	...	...	...	4⅝ — 5 1/16 xd	4½ — 5	...	...
71,447	Do. do. Def. do.	5	...	...	...	4⅝ — 5 1/16 xd	4½ — 5	4 15/16	...
855,000	City and South London Railway	Stock	1⅝ %	2½ %	1⅝ %	64 — 66	64 — 66	65	64½
37,500	Do. do. Ord. shares, Nos. 22,501 to 60,000 ...	10	...	...	...	6 — 7	6 — 7	...	...
82,098	Crompton & Co., Nos. 1 to 82,098	3	...	6 %	...	3½ — 4	3½ — 4	3⅝	...
100,000	Do. 5% 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	...	...	...	...	98 —101 xd	98 —101	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	6 %	...	2 — 2⅛	2 — 2⅛	2	...
17,139	Do. do. do. "A" Shares, 01—017,139	5	6 %	6 %	...	3½ — 4⅛	3½ — 4⅛	...	...
344,023	Do. do. do. 4 % Deb. Stock Red. ...	100	...	...	...	91 — 93 xd	91 — 93	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	2 — 2⅛	2 — 2⅛	2 1/16	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000 ...	2	7 %	7 %	...	3 — 3⅛	3 — 3⅛	...	...
140,300	Do. do. 4% Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	103 —106	104 —107	...	...
9,600	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	7 %	...	10 — 11	10 — 11	...	...
80,000	Henley's (W. T.) Telegraph Works, Ord.	5	12 %	14 %	15 %	13½ — 14½	13 — 14	...	...
80,000	Do. do. do. 4½ % Pref.	5	7 %	7 %	...	5½ — 5⅝	5½ — 5⅝	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½ %	...	...	110 —114	110 —114	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	21⅜	20⅞
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	100 —103	100 —103	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	8½ %	8½ %	8⅝ %	8 9/16 — 8 11/16	9 — 9⅛	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	13½ — 13⅝	13½ — 13⅝	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	35 — 39	35 — 39	36	...
150,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	101 —104 xd	101 —104	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000 ...	5	...	8 %	12 %	10½ — 11½	10½ — 11½	...	...
20,000	Do. do. 5% Cm. Prf. Nos. 1 to 20,000 ...	5	...	...	...	5½ — 6	5½ — 6	...	...
540,000	Waterloo and City Railway, Ord. Stock	100	...	3 %	3 %	98 —101	97 —100	97	...

† Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 8—10.
Brompton and Kensington, 4½ % Debentures of £100, 104—106.
National Electric Free Wiring, 12/6 paid. ⅜—½.
Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 17½—18½.
Do. do. Pref. (£10 pd.), 10—11.
Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 12—13; 1st Preference Cumulative 6 %, £5 (fully paid), 7 —7½. Debentures, 102—104. Dividend, 1899, on Ordinary Shares 11 %.
*T. Parker, £10 (fully paid); 17½.

* From Birmingham Share List.

Bank rate of discount 3 per cent. (June 14th, 1900).

MARKET QUOTATIONS, Wednesday, July 11th.

	CHEMICALS, &c.	This week.	Last week.	Inc. or Dec.
a	Acid, Hydrochloric .. .. .. per cwt.	0/-	5/-	..
a	,, Nitric .. .. .. per cwt.	22/-	22/-	..
a	,, Oxalic .. .. .. per cwt.	32/-	32/-	..
a	,, Sulphuric .. .. .. per cwt.	5/6	5/6	..
a	Ammoniac, Sal .. .. .. per cwt.	30/-	30/-	..
a	Ammonia, Muriate (crystal) .. per ton	£33	£33	..
a	,, ,, ,, ... per ton	£30	£30	..
a	Bleaching powder .. .. per ton	£7	£7	..
a	Bisulphide of Carbon .. .. per ton	£15	£15	..
a	Borax .. .. .. per ton	£17	£17	..
a	Benzole (90 %) .. .. per gal.	7/-	7/-	..
a	,, (50/90 %) .. .. per gal.	5/6	5/6	..
a	Copper Sulphate .. .. .. per ton	£25 10	£25 10	..
a	Lead, Nitrate .. .. .. per ton	£25	£25	..
a	,, White Sugar .. .. per ton	£31	£31	..
a	,, Peroxide .. .. .. per ton	£27 10	£27 10	..
a	Methylated Spirit .. .. per gal.	2/6	2/6	..
a	Naphtha, Solvent (90 % at 160° C.) .. .. .. per gal.	5/6	5/6	..
a	Potash, Bichromate, in casks.. per lb.	9½d.	8½d.	..
a	,, Caustic (75/80 %) .. per ton	£34	£34	..
a	,, Bisulphate .. .. per ton	£25	£25	..
a	Shellac .. .. .. per cwt.	68/-	68/-	..
a	Sulphate of Magnesia .. .. per ton	£4 10	£4 10	..
a	Sulphur, Sublimed Flowers .. per ton	£6	£6	..
a	,, Recovered .. .. per ton	£5 10	£5 10	..
a	,, Lump .. .. .. per ton	£5	£5	..
a	Soda, Caustic (white 70 %) .. per ton	£10 15	£10 15	..
	,, Crystals .. .. .. per ton	£8	£8	..
	Bichromate, casks .. per lb.	9½d.	8½d.	½d. dec.
	METALS, &c.			
b	Aluminium Wire, in ton lots .. per ton	£224	£224	..
b	,, Sheet, in ton lots.. per ton	£191	£191	..
p	Babbitt's metal ingots .. .. per ton	£80 to £150	£80 to £150	..
c	Brass (rolled metal 9" to 12") basis per lb.	7½d.	7½d.	..
c	,, Tube (brazed) .. .. per lb.	10d.	10d.	..
c	,, ,, (solid drawn) .. per lb.	8½d.	8½d.	..
c	,, Wire, basis .. .. per lb.	8½d.	8½d.	..
c	Copper Tubes (brazed) .. .. per lb.	11½d.	11½d.	..
c	,, ,, (solid drawn) .. per lb.	11d.	11d.	..
g	Copper Bars (best selected) .. per ton	£83	£83	..

	METALS, &c. (*continued*).	This week.	Last week.	Inc. or Dec.
g	Copper Sheet .. .. .. per ton	£88	£88	..
g	,, Rod .. .. .. per ton	£88	£88	..
c	,, (Electrolytic) Bars .. per ton	£81	£81	..
c	,, ,, Sheets.. per ton	£90	£90	..
c	,, ,, Rod .. per ton	£84	£84	..
c	,, ,, H. C. wire per lb.	9¼d.	9¼d.	..
f	Ebonite Rod .. .. .. per lb.	8/-	8/-	..
f	,, Sheet .. .. .. per lb.	5/-	5/-	..
n	German Silver Wire .. .. per lb.	1/6	1/6	..
h	Gutta-percha, fine .. .. per lb.	8/- to 8/6	8/- to 8/6	..
h	India-rubber, Para fine .. per lb.	4/- to 4/1	4/ to 4/1	..
i	Iron, Charcoal Sheets .. .. per ton	£18	£18	..
i	,, Pig (Cleveland warrants) per ton	68/6	68/6	..
i	,, Forgings, according to size per ton	From £11	From £11	..
i	,, Scrap, heavy .. .. per ton	70/- to 72/6	70/- to 72/6	..
i	,, Wire galvanised No. 8 .. per ton	£13 5	£13 5	..
g	Lead, English Ingot .. .. per ton	£17 10 to £17 12 6	£17 10 to £17 12 6	..
g	,, ,, Sheet .. .. per ton	£18 15	£18 15	..
m	Manganin Wire No. 28.. .. per lb.	8/-	8/-	..
g	Mercury .. .. .. per bottle	£9 10	£9 10	..
d	Mica (in original cases), small per lb.	8d. to 9d.	8d. to 9d.	..
d	,, ,, ,, medium per lb.	1/9 to 2/9	1/9 to 2/9	..
d	,, ,, ,, large per lb.	3/8 to 7/8	3/8 to 7/8	..
p	Phosphor Bronze, plain castings per lb.	1/1 to 1/4	1/1 to 1/4	..
p	,, rolled bars & rods per lb.	1/1 to 1/4	1/1 to 1/4	..
p	,, r'l'd str'p & sheet per lb.	From 1/8	From 1/8	..
c	Platinum .. .. .. per oz.	£3 13 6	£3 13 6	..
p	Silicium Bronze Wire .. .. per lb.	10½d. to 1/1	10½d to 1/1	..
i	Steel, Magnet, ass'd'g to desc'p'n p. ton	From £15 to £40	to £40	..
i	Steel, Magnet, in bars	£58	£58	..
g	Tin, block .. .. per ton	£144 to £145	£144 to £145	..
g	,, foil .. .. .. per lb.	1/9	1/9	..
n	,, wire Nos. 1 to 18 .. .. per lb.	1/9	1/9	..
p	White Anti-friction Metals— "White Ant" brand .. per ton	£40 to £70	£40 to £70	..
j	Yarns, Cotton, Single 10lb. bundles pr lb.	8½d.	8½d.	..
j	,, Best Flax, 6 lea. .. per lb.	6d.	6d.	..
j	,, Hemp, 8 ply 10 lbs. .. per lb.	4½d.	4½d.	..
j	,, ,, Russian, 10 lbs. per lb.	5½d.	5½d.	..
j	,, Jute, 180 lbs. rove .. per ton	£14	£14	..
k	Zinc, Sheet (Vielle Montagne brd.) p.t.	£24 5 nett.	£24 5 nett.	..

Quotations supplied by
a Messrs. G. Boor & Co.
b The British Aluminium Company, Ltd.
c Messrs. Thos. Bolton & Sons.
d Messrs. F. Wiggins & Sons.
e Messrs. Frederick Smith & Co.

Quotations supplied by
f The India-Rubber, Gutta-Percha, and Telegraph Works Company, Ltd.
g Messrs. James & Shakespeare.
h Messrs. Jackson & Till.
i Messrs. Bolling & Lowe.
j Messrs. Henry C. Yeo & Co.

Quotations supplied by
k Messrs. Morris Ashby, Limited.
m Messrs. W. T. Glover & Co., Ltd.
n Messrs. P. Ormiston & Sons.
o Messrs. Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Company, Ltd.

PROFITS ON TRAMWAY UNDERTAKINGS.*

By C. H. GADSBY, Wh.Sc., M.I.E.E.

All tramway directors and managers and the members of Municipal Tramways Committees are alike interested in the great question of establishing in the working of their undertakings as great a difference between gross receipts and working expenses as it is possible to obtain, and I think, therefore, I need offer no apology for bringing this subject before those of you who have done me the honour of coming to hear this paper.

My only regret is that in the short time at my disposal it is impossible to go more fully into a subject so worthy of investigation and requiring so close a study of detail.

It is an easy matter to increase the gross receipts upon almost any tramway by increasing the services or by affording additional inducements to the travelling public.

It is also an easy matter to reduce the working expenses by curtailing the services, employing cheaper labour, and by many other means, some only temporary, others permanent.

The problem is—how to increase the gross receipts without at the same time unduly increasing the working expenses.

It is not sufficient merely to establish a low *ratio* between working expenses and gross receipts unless at the same time the actual *difference* between them is great.

Table A.

Year.	Mileage.	Passengers.	Gross receipts.	Receipts per car mile.	Working expenses.	Expenses per car mile.	Ratio receipts to expenses.	Net receipts.
			£	Pence.	£	Pence.	%	£
1893	260,153	4,079,993	17,939	16·5	12,327	11·3	68	5,612
1894	267,150	4,250,343	19,187	17·2	12,793	13·7	62	6,394
1895	370,373	5,286,608	23,271	15·07	14,022	9·08	60	9,249
1896	418,840	6,425,348	28,033	13·6	14,984	8·5	53	13,049
1897	470,612	7,450,492	32,316	11·5	16,908	8·6	52	15,408
1898	497,813	8,144,917	35,393	17·06	19,861	9·5	56	15,532
1899	523,073	8,818,047	38,453	17·6	20,438	9·3	53	18,015

Naturally the first direction in which one turns for improvement is towards increased gross receipts.

Such an increase may be effected by raising or reducing the fares according to circumstances, by increasing the services, by putting on better cars, by better heating and lighting, by better attention, and by numerous other means, but of course the increase of service is the one to which receipts respond most readily.

The Table A shows the increments in receipts upon a certain English steam tramway resulting almost entirely from the gradual and judicious adoption of more frequent services.

In this instance it will be seen that the mileage has been doubled in seven years; the number of passengers has been more than doubled, as have also the gross receipts, whilst the working expenses have been increased only about 70 per cent., and the resulting net receipts have been multiplied by 3½.

This has been effected without any change of system, without any unusual development in the district or any extension of the line.

There has been a substitution of a portion of double line for single, to permit of the more frequent service, but the improvement may be justly attributed simply to the increased service.

Table B.—Operating Expenses on English Horse Tramways.

Line.	Maintenance of permanent way.	Horse-power.	Renewals of horses.	Repairs of cars.	Traffic expenses.	All other expenses.	Totals.	Mileages.
	£	£	£	£	£	£	£	
A	2,223	21,418	1,797	3,430	18,824	4,676	52,368	1,502,448
B	113	4,614	315	412	3,884	2,356	11,694	293,343
C	1,656	15,491	2,000	2,164	12,178	2,496	35,985	870,286
D	1,504	9,467	1,224	1,148	8,108	1,671	23,122	646,150
E	2,010	11,938	2,711	3,445	8,495	8,335	36,934	749,461
Totals	7,506	62,928	8,047	10,599	51,489	19,534	160,103	4,061,688
Average pence per car mile.	0·44	3·72	0·47	0·63	3·05	1·15	9·5	—

It is interesting to note that in this case the receipts per car mile have increased from 16·5d. to 17·6d., whilst working expenses have fallen from 11·3d. to 9·3d., and the ratio of working expenses from 68 per cent. to 53 per cent.

It is not to be expected that the gross receipts can be increased in the same proportion as the mileage, and consequently as a general rule the receipts per car mile are reduced.

It is a knowledge of this fact that has in many instances led tramway managers to adopt the policy of restricting the mileages in an endeavour to secure high receipts per car mile.

Receipts per car mile on British tramways vary from a lower limit in the region of 7d. to a higher one approximating to 2s. per car mile.

Except under very exceptional circumstances any manager working a line so as to obtain gross receipts anywhere in the neighbourhood of this higher limit does not fully appreciate the necessities of his district or of the earning capacity of his system.

I consider that for electric and cable lines any rise in receipts per car mile above 9d. should be at once checked by an increased mileage.

Table C.—Operating Expenses on English Steam Tramways.

Line.	Maintenance of permanent way.	Locomotive power.	Repairs of engines.	Repairs of cars.	Traffic expenses.	All other expenses.	Totals.	Mileages.
	£	£	£	£	£	£	£	
A	3,291	1,586	1,486	581	4,474	1,610	13,128	248,735
B	3,627	16,335	7,990	1,739	6,051	2,879	38,621	883,991
C	625	1,048	282	...	3,948	2,568	8,471	188,348
D	2,139	8,223	4,030	1,130	3,178	3,058	21,798	472,652
E	984	1,748	889	388	1,446	736	6,191	181,739
Totals	10,666	28,940	14,677	3,838	19,097	10,851	88,209	1,975,465
Average pence per car mile.	1·30	3·51	1·78	0·46	2·32	1·31	10·7	—

In the case of horse tramways a similar process should be applied whenever the receipts rise above 1s., and in steam lines when above 1s. 2d. or 1s. 3d.

Take an example:—Suppose we have a system running 1,000,000 car miles per annum with gross receipts at 1s. per car mile:—

Total gross receipts will then be ...	£50,000	per annum.
Suppose working expenses are at 60 per cent., and therefore amount to	30,000	„ „
Net receipts will be	£20,000	„ „

Let now the mileage be increased 20 per cent., that is, to 1,200,000 car miles per annum, and suppose the total gross receipts increase only at the less ratio of 15 per cent., and that in consequence of standing and managerial charges being spread over a greater mileage, the working expenses increase only 15 per cent. also. We shall then have—

Total gross receipts	£57,500	per annum.
Total working expenses	34,500	„ „
Net receipts	£23,000	„ „

In this case the gross receipts per car mile work out at 11½d., that is by increasing the mileage 20 per cent. we have reduced the receipts per car mile from 1s. to 11½d., but have at the same time made an extra £3,000 per annum clear profit.

It may be of interest to compare the working expenses of tramways with different motive powers.

Table B may be taken as a fair average of the working expenses of a horse tramway. It is derived by taking the average of the actual figures on five representative town tramways in this country for the year ending June 30th, 1899.

From this it will be observed that the average total working expenses amount to 9½d. per car mile, whilst horse power with renewals amounts to 4·19d. per car mile, and traffic expenses to 3·05d.

Table C shows a similar statement of working expenses for steam tramways derived from the actual figures for representative tramways in this country.

The striking figure in this table is that engine power costs 3½d. per car mile whilst repairs cost 1⅞d. per car mile, together making 5½d.

The permanent way repairs are naturally heavier than for horse traction, the traffic expenses are lower, chiefly on account of the drivers' and conductors' wages being spread over a greater mileage in consequence of the higher speeds than with horse traction.

The total costs amount to 10⅜d. per car mile, or 1d. per car mile higher than for horses, so that the advantage of steam over horse working is due to the higher receipts per car mile consequent upon the use of larger cars.

Table D gives the working expenses for eight electric lines in this country.

All of the lines are operated on the overhead system some by their municipal owners, and others by companies.

It is in this case somewhat difficult to apportion the costs on account of the lack of uniformity in the allocation of charges.

It will be noticed that the cost of motive power is much lower than with horses or steam, being only 1·36d. per car mile, or with engine and dynamo repairs 1·685d.

* Paper read before the Tramways and Light Railways Association at the Agricultural Hall Tramways Exhibition, Islington, Friday, June 29th.

It might be expected that the items for car repairs would be higher than with horse or steam traction on account of the repairs of motors and electrical equipments being now included, but as a fact the figure per car mile is about the same. I think this is accounted for by the fact that although the expenditure on each electric car is greater than on each steam or horse car, the charge per car mile is not greater on account of the greater daily mileage run by an electric car.

The item for traffic, which, of course, consists chiefly of drivers' and conductors' wages, is much the same for all three systems.

The total expenses of 6·8d. per car mile is somewhat higher than is generally expected with electric traction, this being due to the inclusion in the list of a number of small undertakings recently started upon which it is reasonable to suppose improvement will be effected.

When data is available from the many larger municipal undertakings just open or undergoing conversion, it is evident that an average total expense between 5d. and 6d. per car mile will be easily attained.

TABLE D.—OPERATING EXPENSES OF ELECTRIC TRAMWAYS IN GREAT BRITAIN.

Line.	Maintenance of permanent way.	Motive power.	Repairs of general plant.	Repairs of cars.	Traffic expenses.	All other expenses.	Totals.	Mileage.
	£	£	£	£	£	£	£	
A	1,277	1,722	954	1,401	3,837	1,855	11,046	283,718
B	811	939	159	427	3,703	927	7,676	239,472
C	350	1,545	505	700	2,206	924	5,725	204,257
D	557	3,404	330	1,307	3,349	2,792	11,739	267,750
E	172	856	709	201	1,413	1,231	4,582	135,740
F	12	1,104	250	336	1,535	454	3,691	161,156
G	2,121	1,700	394	460	7,784	1,398	13,857	564,389
H	4,362	6,191	535	2,430	9,768	4,971	28,257	1,160,279
Totals	9,662	17,465	3,836	7,262	33,595	14,552	86,573	3,016,761
Average pence per car-mile.	·765	1·38	·305	·576	2·67	1·15	6·896	—

In some cases in the table this has already been done. In the instance of line H the figures work out at 5·8d. per car mile, and on line G at 5·75, whilst at Leeds, which is not included in the list, total working expenses are reported well under 5d. per car mile.

Table E gives the operating expenses per car mile well in detail for 23 American electric roads, and it is interesting to observe how closely this agrees with English working, notwithstanding the very different conditions.

Four years ago I had some difficulty in persuading a director of a certain large tramway undertaking in this country that there would be any reduction of working expenses by the adoption of electric traction, and at that time the figures I have given were not available.

It is now scarcely necessary to point out that these figures show beyond doubt the great saving to be effected by the adoption of electric traction.

TABLE F.—GENERATING PLANT FOR VARIOUS NUMBERS OF CARS IN SERVICE ON ELECTRIC LINES UNDER ENGLISH CONDITIONS.

No. of cars	5	10	15	20	25	30	35	40	45	50
No. of sets of generating plant including reserve...	2	2	2	2	2	2	3	3	3	3
Power of each set in KW. ...	16	125	175	225	275	300	175	200	200	225

No. of cars	55	60	65	70	75	80	85	90	95	100
No. of sets of generating plant including reserve...	3	3	3	3	3	3	3	3	3	3
Power of each set in KW. ...	250	250	275	275	300	300	325	325	350	350

This is the means that will be taken to reduce working expenses on every horse and steam tramway throughout the country during the next five or six years.

Having adopted electric traction there is still necessity for carefully watching operating expenses.

In the first place the expenditure on track repairs may be anything from ·05d. per car mile to 1·5d.

It is necessary to keep sufficient men on the track to keep pace with the wear, and the old proverb, "a stitch in time saves nine," is eminently applicable to track repairs, but it is at the same time an easy matter to waste money by having too many men on the work, who will always find or make something to do.

Then again the item for motive power may be anything from ·5d. to 2·0d. per car mile.

The first care in this respect should be as to the consumption of current upon the cars, which may on level roads with small cars and careful manipulation of the controller work out as low as ·6 B.O.T. units per car mile, or may on heavy roads with careless driving amount to 1·3 or 1·4 B.O.T. units per car mile.

TABLE E.—OPERATING EXPENSES ON AMERICAN ROADS.

DISTINGUISHING No. OF ROAD	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Miles of track (as single)	48·6	13·65	11·15	6·29	30·56	64·71	12·93	10·5	17·0	4·75	11·25	25·5	7·2	7·25	16·85	12·46	1·5	10·24	11·46	5·25	4·11	16·77
No. of cars. Open	71	30	30	15	46	80	15	13	25	9	10	39	16	9	9	14	..	7	50	2	2	52
" Closed	45	12	11	10	53	78	12	8	21	4	10	34	6	9	8	13	3	6	20	3	3	30
"				+8 freight																		
" Ploughs	7	3		1	2	18						4	1	1		1			2			4
" Sweepers	2				1		2	3	4	1	1								1			
" Sprinklers	1		1	1																		
Car-miles per annum ..	1,731,147	401,294	350,035	397,319	1,395,690	2,814,072	354,895	337,590	588,951	117,699	800,408	1,181,206	212,323	241,532	880,390	927,905	49,385	186,060	490,056	61,200	3,916	921,408
Passengers per annum ..	6,888,508	2,000,458	1,661,703	1,049,044	5,588,585	10,854,971	681,886	639,555	2,061,094	487,694	1,181,588	4,466,080	1,196,548	1,000,849	1,196,975	1,967,519	101,968	620,082	2,893,084	197,555	5,669	6,345,548
Average No. of employés	200	65	46	30	186	470	60	24	75	15	33	165	28	27	30	45	7	27	75	8	5	150
DETAILS OF OPERATING EXPENSES—	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.
Road-bed and track	·695	·405	·175	·085	·250	·475	·555	·340	·395	·185	·005	·300	·970	·040	·295	·815	·305	·305	·385	·775	·005	·190
Building repairs and fixtures ..	·220	·020	·045	·125	·055	·028	·180	·020	·010	·005	·006	·090	·050	·015	·010	·020	·195	·020	·020	·005	·005	·020
Electric line construction repairs	·910	·175	·045	·080	·105	·975	·245	·020	·130	·005	·385	·240	·040	·045	·185	·085	·105	·095	·105	·005	·005	·145
Car repairs	·815	·455	·250	·040	·165	·430	·655	·045	·185	·035	·075	·325	·830	·355	·170	·245	·245	·185	·435	·435	·105	·340
Repairs to electric gear on cars ..	..	·100	·165	·325	·205	·340	·550	·175	·430	·130	·065	·240	·200	..	·105	·245	·150	·135	·180	..	..	·340
Electric motive power	·555	1·500	1·483	·610	·630	·455	1·080	1·210	1·195	2·045	1·080	1·100	1·800	1·460	1·295	1·980	1·195	2·190	1·490	1·050	1·785	1·695
Wages	9·015	2·575	2·966	2·845	2·935	3·155	2·980	1·655	2·060	2·660	2·775	2·610	2·470	3·110	2·990	3·100	1·465	2·915	3·565	2·690	2·100	3·640
Removal of snow and ice	·090	·050	·020	·010	·045	·100	·025	..	·015	·035	·015	·020	..	·025	·045	·080	..	·085	·090	..	..	·010
Damages, gratuities, &c.	·095	·095	..	·140	·045	·185	·150	·105	·145	·005	·015	·025	·400	·055	·045	·415	·050	·015	·090	..	..	·035
Insurance	·585	·095	·090	·055	·045	·045	·135	·105	·065	·035	·065	·080	·060	·055	·090	·210	·210	·060	·140	·025	·020	·065
Salaries	·345	·065	·540	1·005	·765	·260	1·240	·135	·475	·065	·065	·235	·800	1·000	1·130	1·130	1·035	·360	·360	·065	·025	·615
Horsing expenses	·030	..	·270	..	·015	·075	..	..	..	·045	..	..	..	..	..	..	..	·190	·065	·495	..	·070
Legal expenses	..	·315	..	..	..	·030	..	..	..	..	..	..	..	..	·020	..	..	..	·190	..	..	..
General expenses	·345	..	·240	·045	1·175	·440	·140	1·735	·900	·500	·050	·340	·465	1·405	·440	1·020	·275	·995	·400	..	8·685	1·130
Miscellaneous other expenses ..	..	·695	5·995	8·015	7·640	6·530	9·505	6·065	6·400	6·755	5·670	5·280	7·065	8·125	6·695	9·810	5·455	6·725	7·300	5·075	14·955	8·915
Total operating expenses per car-mile	4·930	7·515	9·300	10·455	10·740	9·440	10·640	7·725	8·900	9·020	5·670	9·300	12·40	11·08	8·670	14·950	5·240	8·805	14·005	5·840	16·545	13·695
Gross receipts	9·390	10·650	9·300	10·455	10·740	9·440	10·640	7·725	8·900	9·020	5·670	9·300	12·40	11·08	8·670	14·950	5·240	8·805	14·005	5·840	16·545	13·695

Having reduced the consumption of current upon the cars, the next point is to secure its economical production. To effect this it is necessary to see that the fuel is of the most suitable character, having due regard to cost, and remembering that the lowest priced fuel is not always the cheapest, and that the furnaces are of the best type for dealing with it.

It is also of the utmost importance for economical production that the engines and dynamos are of the proper power, so as to be fairly fully loaded without risk of injurious overloading in the heavy fluctuation of traffic.

In Table F I give the sizes of a generating plant I have found suitable for operating lines with various numbers of cars under ordinary conditions.

It is of course important that the plant shall be of the most economical description, but judgment must be used in selecting the plant, as to whether it shall have simple, compound or triple expansion engines, and as to whether it should be even condensing or non-condensing, as particularly in small plants in districts where fuel is cheap it may be found that where repairs, attendance, water, &c., are taken into account, it may be cheaper to adopt a non-condensing engine using 25 lbs. of steam per indicated horse-power than a condensing engine using, say, 18 lbs. of steam per 1 H.P.

Then again there is the all-important matter of traffic expenses, which generally amount to about half the total cost of operating electric cars.

Wages and hours for drivers and conductors are now fairly uniform throughout the kingdom, and there is not much scope for cutting in this direction, and it is in the careful arrangement of shifts, and in the reduction of lost time at end stops that reductions may be made.

On many lines with short branches a very large proportion of the men's time is wasted whilst the cars are standing at termini. Cars should as far as possible be kept moving all the time, only sufficient time being allowed at the ends of the journeys to allow for turning the trolley pole and loading.

In this way a good deal more mileage will be got out of both men and cars.

With the higher speeds in America it is common practice to get 100 to 120 miles per day out of a car, whilst in this country there are plenty of instances where electric cars are only doing 35 to 40 miles per day. Even with the limitations of speed to which we are here subjected much better than this should be done.

These remarks have been based upon the operation of overhead trolley lines, but apply generally to electric conduit lines upon which, if substantially built, the working expenses will be much the same, the only difference being a small increase for repairs and maintenance of the conduit, conductors and collectors.

I have not included any statement as to the operation of cable lines, although these are worked at remarkably low rates, as low in fact as many electric lines, chiefly because there are only three systems of any magnitude in operation in this country, and there has been very little recent development in them.

I think we are justified in drawing from this small investigation the following conclusions:—

1. That it is generally possible by increased services to increase the gross receipts.
2. That the operating expenses do not increase at the same rate as the mileage, and generally at a less rate than the receipts.
3. That services judiciously increased generally result in larger net profits.
4. That electric traction constitutes the readiest means of increasing the receipts, and at the same time of reducing working expenses.
5. That on tramways already equipped in this country there is scope for reduction of operating expenses and increase of profits.

I have to acknowledge my indebtedness to the *Street Railway Journal*, New York, to the Compiler of the "American Street Railway Investments," and to the officials of the various undertakings, whose figures have been cited, for their kind assistance in the preparation of this paper.

I trust this short paper may have been of interest to some of you, and that it will induce you to express your views on the points raised, so that we may have the benefit of your valued opinions on subjects with which you are in such close contact.

IRON AND STEEL RAILS IN AMERICA.

An interesting paper on the above subject, by Mr. Robert W. Hunt, was read at the Annual Convention of the American Society of Civil Engineers held in London at the beginning of last week. After reviewing the history of iron rails and their replacement by steel, the author referred to the fact that the first rail ever made from Bessemer steel was placed on the Midland Railway early in 1857, in a position where the traffic was such that iron rails had to be renewed as often, sometimes, as every three months. The Bessemer steel rail, however, did duty there until June, 1873, some 16 years, during which time about 1,250,000 trains, and any number of single engines had passed over it. There can be no doubt that the enormous expansion which has taken place in the development of the railway systems throughout the world would have been impossible without the discovery of a means of making steel rails cheaply.

The author referred also to the many attempts to make a composite rail having an iron base and web with a steel-capped top. All these devices were fruitless, and the Bessemer steel rail soon proved itself to be master of the situation. The first steel rails laid down in America were imported by the President of the Pennsylvania Railway, and the first steel rails manufactured in America were turned out at Chicago on May 24th, 1865. Since then the development of steel rail rolling mills has proceeded apace in America, and Mr. Hunt is of opinion—without wishing to draw any invidious comparisons—that at the present day American makers are not only rolling the greatest quantity of rails, but are producing at the same time the best finished rails in the world.

Mr. Hunt speaks a word in praise of the McKenna process of renewing rails. Mr. McKenna subjects rails which have become unfit for further service on main lines, to a heat of not more than 1,500° F. in a long furnace. They are then drawn from the furnace by a mechanical device, which simultaneously removes any scale which may have formed on the surface, and slightly upsets or flattens the section. The rail is then passed through a set of forming rolls and given a finishing surface in another mill. The original finishing section and height is maintained, although the area of the section has been somewhat reduced.

The process can no longer be said to be in the experimental stage. Indeed, the wear of the renewed rails bids fair to be more satisfactory than that obtained from new rails of heavier sections. There are nearly 100,000 tons of renewed rails in service on the Chicago, Milwaukee, and St. Paul Railway, the Alchison, Topeka and Santa Fé, the Wabash, and other systems.

Mr. Hunt states that one chief engineer (who, apparently, must hail from this side of the ocean), on whose railway many renewed rails are in use, is of opinion that "No rail ought to be used at all until after it has been renewed."

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be as brief and concise as possible. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy o the views which he may express.*]

Consumer writes:—"I should be glad to know whether a failure by an electric supply company to provide an unintermittent current renders them liable to an action at the hands of a consumer. The penalties imposed are in some cases not only too small to prevent a recurrence of the evil, but are often insufficient to compensate the hapless consumer for the inconvenience caused by the sudden extinction of all the lamps in his house. Would you be kind enough to say whether proceedings at law would avail the consumer in such a case, either in addition to, or in substitution for, the recovery of a penalty as provided by statute?"

*** Although the question put by "Consumer" has not yet arisen so far as we are aware in relation to the supply of electricity, it has been frequently discussed in connection with gas and water supply. The result of the decisions may be said to be that where a duty is cast by statute upon a company or person, and penalties are imposed for failure on the part of the company to perform that duty, the company are only liable to pay penalties [Atkinson *v.* Newcastle Waterworks Company, 2 Ex., D. 441]. Now it is clear that under the Electric Lighting Acts, 1882—1899, that an electricity supply company are bound to furnish their current without favour or distinction to all persons within their district, and it is also clear that they become liable to penalties in case of refusal. Hence the jurisdiction of the courts is ousted. It might be argued that in many cases a company have been held liable both to penalties and to an action, but a reference to those cases will show that the double remedy is only available in respect of the *commission* of Acts which the company are prohibited from doing or suffering to be done. Thus, in Goodson *v.* Sunbury Gas Consumers' Company [75 L. T. 251], it was held that an action would lie for nuisance which resulted in an injury to the plaintiff when driving through the streets, although the company were also liable to penalties under the Gas Works Act (10 V., c. 15).

CURRENT SPECIFICATIONS.

XX.—SALFORD ELECTRIC TRAMWAYS.

Summary.

Extent of Contract.—The overhead equipment of several electric tramway routes in Salford.

Schedules Required with Tender.—No particulars are given as to the routes to be equipped, but full schedules of the work to be done are given, which must be filled up by tenderers.

Approximate Length of Line.—15¼ miles.

Poles, Bracket Arms, and Cast-Iron Bases.—To be provided by Corporation, only delivery from central power station and erection being included in this contract.

Trolley Wire.—To be 0·324 inch diameter, not less than 98 per cent. conductivity, and capable of withstanding a strain of not less than 4,800 lbs. The calculated strain on wires to be not more than 1,700 lbs.

Span Wire.—To have a breaking strain of not less than 2,000 lbs., and sag of approximately 12 inches.

Section Boxes.—To comply with specified requirements.

Guard Wire.—To be of No. 8 steel, or an approved stranded cable of equivalent strength, fixed to each support if necessary, to comply with all requirements of Postmaster-General and Board of Trade.

Specified Date of Completion.—None stated, though reference is made to it in the general conditions as appearing in the specification, probably the intention is that it should be stated by tenderers.

Penalty for Late Completion.—One half of 1 per cent. of contract sum per week.

Stipulations as to Removal of Foreman.—See below.

Stipulations as to Wages paid to Workmen.—See below.

Arbitration Clause.—None provided; see comments below.

Date for Receipt of Tenders.—July 16th, 1900.

This specification has been prepared by the consulting engineers to the Corporation, Messrs. Lacey, Clirehugh and Sillar, and differs from usual overhead equipment specifications in that no information is given as to the streets in which the work is to be done. Provision is made for the supply to contractors after the contract has been assigned of plans of proposed routes, and presumably though it is not expressly stated, these plans could be inspected by tenderers; but in the specification itself, beyond the approximate total length and the scheduled quantities, there is no direct information on this important point.

It is stated in the specification :—

The numbers and lengths given in the schedule below must be taken as approximate only, and as indicating the total amount of the work which the Corporation anticipate will be required, but *the rates filled in by the tenderer must be considered to any less quantity of work, or to any greater quantity (within a limit of fifty per cent. on the total cost)* for which instructions are given *within eighteen calendar months from date of contract.*

In the first place, a possible variation in work tendered for and work actually done of *fifty per cent.* is excessive. It will prevent the figures sent in being as favourable as they otherwise might be, as the tenderer, who has no knowledge of the requirements of the Council beyond that given above, must cover in his prices the risk of a possible reduction of *fifty per cent.* in the work to be done.

Further, it is not fair to expect that in the present state of markets for material any firm without making large provision for the risk can give schedule rates for the supply of materials to be ordered possibly *eighteen months hence.* A shorter period might be reasonable, but the attempt on the part of some public bodies to place the risk of variations in the prices of materials upon the contractor for such lengthened periods is unfair to the contractor should prices rise considerably, and unjust to the ratepayers should there be a fall in prices. A ratepayer has the right to purchase at the current rates of the day, and no Council ought to bind its possible successors to purchase at fixed rates from one contractor over so long a period. The powers of an elected council are limited to as great an extent as possible by the period over which it holds office, and great care should be taken as to the extent to which by its actions it binds its successors.

So far as the technical requirements of the specification are concerned, there is little to criticise. Care has been taken to demand high-class work, but no undue or inconsistent demands are made. The poles and accessories are to be supplied by the Council, but their erection forms part of the present contract. Provision is made in the schedule for a double trolley wire throughout.

The general conditions are in several respects unsatisfactory, and are not rendered in any sense more acceptable by the following clause in the tender form, which must be filled in, signed, *and sealed* by the tenderer.

The undersigned do hereby offer and agree to supply the materials and to perform the whole of the works described and set forth in the preceding specification and schedule of prices, *in strict accordance with the general conditions, dated February*, 1900, *applying to all specifications in relation to the said electricity works* and the preceding specification, prepared by your engineers, and to their satisfaction, for the sum of £ , and also hereby further agree that *the value of all additions or deductions which may be made to or from the works aforesaid shall be determined by the engineers.*

It should be borne in mind that there is no provision for arbitration in this contract, and that any disputes are left to the sole decision of the engineers. In view of the possible excessive difference between the amounts of work tendered for and actually done, we strongly advise that a strong stand be made by all tenderers against this stipulation, and suggest that all offers should insist upon the insertion in the contract of the standard arbitration clause in the form agreed upon between the representatives of the Municipal Electrical Association and the Electrical Plant Manufacturers' Association.

Seeing that the routes are not mentioned in the specification, the following is to a large extent an unascertainable risk, and ought not to be accepted without further information :—

The contractors shall comply with all the provisions and regulations affecting the works in Salford, and with the rules and regulations and requirements of all public bodies, companies, or persons whose properties or rights are affected by the works, and shall procure all licenses, and deposit all plans, and give all notices which may be requisite.

In the clause relating to the powers of the engineers to object for good reasons to the employment of any particular workman, we find the claim that such workman must be *dismissed*, not merely removed. This may seem a small point, but in reality it means the assumption by the engineer of a control over the relations between the contractor and his workmen far beyond the rightful relations of purchaser and contractor.

The clause reads :—

The contractors shall afford all necessary superintendence during the execution of the works, and shall constantly employ on each part thereof at least one good and competent foreman, skilled in the trades and callings required by this specification, and such foreman shall, on behalf of the contractors, have charge of such drawings, writings, papers, specifications and documents as may be delivered to or for the use of the contractors; and such foreman shall also, on behalf of the contractors, obey all instructions and directions as may be given by the engineers or their authorised representatives, or by any person authorised in writing by the Corporation to give such directions, and any instructions given to such foreman shall be deemed to be given to the contractors; *the said foreman, if objected to by the engineers, shall be dismissed by the contractors*, and the contractor shall replace him with another competent foreman *The engineers shall also be at liberty to object to any person employed by the contractors in the execution of the works who shall, in the opinion of the engineers, misconduct himself or be incompetent or negligent, and the contractors must dismiss the person so objected to and employ another in his place.*

The clause giving the engineers power to extend the specified date of completion might well be copied in other contracts, it suits all reasonable requirements. It states :—

If the completion of the works, or any part thereof, shall have been delayed by inclement weather, combination of workmen, strike or lock-out, or by any unforeseen circumstances (other than lack of money) which the engineers may consider to have been beyond the control of the contractors, then the engineers may allow such extension of the time for completion of the works as shall seem to them reasonable.

The labour clauses are far more reasonable than in the specification recently issued by the neighbouring borough of Manchester. They simply stipulate that :—

All workpeople employed in connection with the contract shall be paid the standard rate of wages for the time being prevailing in the district where the work is carried out. In the event of the contractor violating this condition, the Corporation may declare the contract null and void upon such conditions as they may reasonably deem necessary, and the contractors shall be responsible for any loss occasioned thereby.

In case the terms of the contract be not duly performed by the contractors, the contractors shall pay to the Corporation a penalty of £500.

Another very fair clause relates to sub-letting, a matter of necessity in a contract such as this, where apparatus of widely differing character is largely employed.

We find it stated that :—

The contractors shall not assign their contracts, or any part thereof, without the consent in writing of the engineers, nor may they underlet the same, or any part thereof, nor make any sub-contract with any person or persons for the execution of any portion of the works, unless such sub-contractor shall be approved of in writing by the engineers. It is not intended by this clause that the contractors shall necessarily be the manufacturers of all materials or appliances which they may employ, but that the names of the makers of all such materials or appliances shall be submitted to the engineers for approval, and no sub-contractor shall be allowed to do work within the buildings of the Corporation except by the special instructions of the engineers.

From the above remarks it will be seen that the principal fault, so far as the general conditions go, is the omission of any arbitration clause. Were this rectified, very slight modification would render the other clauses acceptable. We would again urge upon tenderers insistance upon its inclusion in the final contract.

ELECTRIC TRACTION.

By RANKIN KENNEDY.

In the evidence given on the municipal trading inquiry, Mr. A. A. Campbell Swinton gave it as his view of electric traction, that while it would have its day, the motor car would eventually drive it out. A consideration of the question by anyone acquainted with the inside details of the matter, reveals considerable ground upon which to found such an opinion.

The motor car has made far more progress with less outside assistance, than trolley or conduit traction systems ever did, and improvements are going ahead by leaps and bounds, so that the many defects and disabilities under which these vehicles have laboured will speedily disappear. The competition will be between vehicles running on rails alongside of trolley poles, and vehicles running on any fairly good open road, and capable of going almost anywhere.

On roads, where much traffic in motor cars would be common, the old pioneer road plates first used by Outram, from whose name the word tramway came, could be employed again, as they were in the old light railways before the locomotive with its flanged wheels and bulb rails came into use. Electric trolley or conduit traction systems are properly called in America *street railways*.

In towns the contest will be between street railways and street motor cars, the one confined to the railway line along certain routes of trolley wires, the other free to run along any road, with or without plates.

The laying of tram plates throughout a town or city is a comparatively cheap affair. But no matter how perfect a motor car may be, it could never compete with a street railway unless worked on a rigid system. To let them loose in the streets on the wild, barbaric, chaotic system on which London 'buses are allowed to run, would mean failure. The tramway, confined to a definite line with fixed stopping places, means orderly and paying business.

Similarly a plate line in streets for motor cars, to which they would be confined, and with stopping places at intervals, would make motor cars very serious competitors, even in their present imperfect state, and they would have the considerable advantage of being able to run when and where necessary on the common surface, without the plate line.

It seems, therefore, that all that is now wanted to give motor cars a great advance is to provide for them a plate line. This would be a cheap addition to a street, and would be a great improvement in many small towns over 'buses or horse cars, and better than a trolley system.

Motor car enthusiasts seem to be pursuing a wrong course in attempting long-distance fast-speed cars on common roads. The big field for motor cars is in towns and cities on a smooth steel plate rail carrying a constant stream of paying customers 16 hours a day in a well-managed, orderly manner.

In good paved streets like London streets, no plate or rail would be necessary: nor would it be desirable in such crowded, crooked, narrow thoroughfares. Along these the motor cars would glide quietly and smoothly. Where plates would be advisable they could be laid without interference with the ordinary traffic. On these plates, motor vehicles, however driven, steam, electric, gas, oil, or compressed air, could run, no matter (within wide limits) what their wheel base may be.

High speeds and long distances such as are covered by ordinary railways can never be approached or superseded by either electric trolley or motor cars; at any rate, not for passenger carriage. People will never again return to the roads for travelling, except for short distances, and where no railways exist, and where it is considered a pleasure to go by road.

Underground traction in tunnels has two systems, cable, and electric trolley. Here there can be no doubt as to the superiority of the electric trolley over all others.

It would seem, to sum up the present position of traction, that steam locomotives on ordinary railroads have no competitors worthy of consideration in heavy high speed work and long distances,

The electric trolley and the motor car will both compete against the horse, mule, and ass, and when, between them, these animals have been annihilated in road traction, the contest will finally be between trolley and motor car.

The writer agrees with Mr. Swinton in the opinion that the motor car will come out first, when perfected and worked on a proper tramway system.

As to the motor cars themselves, these have made wonderful progress, but still require improvement: the choice lies between steam, internal combustion motors, and electric accumulators. Steam and accumulators are too heavy at present as they have hitherto been worked.

Improved accumulators, worked on a rational system, should do far better than they have done in past trials. The more one studies the facts of accumulator traction and the behaviour of cells, the more one feels they have been badly used, or, rather, abused.

It is worthy of note that in trolley electric traction, from the very beginning, twenty years ago, there was not one single problem of the slightest difficulty. All that was required to establish it was the energy and money of its promoters; they put their money on a dead certainty and attacked the easiest problem first.

Not so with accumulator traction. If there was any unsuitable application it was to cabs; a hire cab is subject to no rule as to its journeys, it is uncertain in its engagements and movements, its supervision is almost impossible, and the cells are worked under the worst possible conditions.

The electric omnibus idea was correct from a business point of view, and, no doubt, will be revived again when a thoroughly sound engineering design is worked out for their mechanism and working.

A vehicle running daily a given mileage along a given route a certain number of hours per day presents a mere shadow of the difficulties in the way of hire cabs. Batteries for traction have, in tramway work, mistakenly been always made for and worked at discharges over far too long periods of time.

Notwithstanding past failures, there is still hope for battery traction if properly set about, more especially with recently improved cells.

At the moment, the internal combustion motor is foremost for light vehicles and boats, being by far the cheapest and lightest motor. But for luxurious travelling, short distances, with silence and cleanliness, nothing can be better than the electric battery car, although it is expensive to run.

On the whole, it is not to be concluded by any means that the electric trolley system is to be the only and final system of street railways, road traction, or even light railways. Like the stage coach, the canal, the candle, and the gas jet, it will "have its day."

REPORT OF THE DEPARTMENTAL COMMITTEE ON THE PATENT OFFICE.

The report has been published (by Messrs. Eyre & Spottiswoode) of the Departmental Committee on certain suggestions which have been made for developing the benefits afforded by the Patent Office to inventors. The summary of the Committee's recommendations is as follows:—

1. (*a*) That classified illustrated abridgments of all specifications from 1617 to 1883 should be made, and the work completed by the end of 1906. (*b*) That volumes of collected abridgments for each of a limited number of leading subjects of invention should be placed in the Patent Office library as an experiment.

2. That no action should be taken as regards the issue of reminders for payment of renewal fees.

3. That authority should be given to the Comptroller-General to reprint specifications of expired patents for which there is a demand.

4. That a system of deposit accounts for Patent Office publications should be experimentally adopted.

5. That the annual allowance for the purchase of books and for binding for the Patent Office library should be increased for the next three years, and that a special sum should be allowed for the purchase of books already selected but which cannot be supplied for want of funds.

No. 1 (*a*) consists merely in hastening forward the work already taken in hand by the Patent Office. The utility of the abridgments is unquestioned, and their completion will be welcomed by all who have to use the Patent Office library. At present there are 146 classes of subject matter, and the present work of abridgment has been divided into seven periods of different lengths. When completed, therefore, the whole set of abridgments from 1617 to 1900 will be contained in 1,022 volumes. This will make a complete and intelligible set of abridgments to the end of the current year. The work includes the re-abridgment of those periods which are at present imperfectly abridged, and all the abridgments will be illustrated.

Recommendation No. 1(*b*) is a further development of the system of abridgments. Instead of having, as at present, seven volumes of each of the 146 classes, covering the period from 1617 to 1900, it is proposed to sub-divide each of the 146 classes into seven sub-divisions and bind together all the abridgments of patents in each sub-division during the whole of the above years in one volume. The number of volumes under this system of division would remain the same, viz., 1,022, and the system will, we think, more fully meet the objects aimed at, viz., assisting searchers in their work. The greatest benefit will, of course, accrue to those who indulge in "fireside searches." It is recommended that this innovation be tried experimentally with a few of the leading heads of subject matter, and that the expense of printing be not incurred till the Comptroller-General has had opportunities of watching its working.

No. 2.—The Committee recommend that no action be taken with regard to the issue of reminders for the payment of renewal fees. The reasons given for this decision are many, but not very convincing. They may be summarised and answered shortly as follows:—

(*a*) The information as to renewal fees is endorsed on the back of each patent, and the letter sent to each applicant with the patent, directs attention to this endorsement. The patentee therefore has express notice of his obligations.

Even the most express notice possible is apt to be lost sight of after the lapse of four years.

(*b*) In 1898 10,792 patents expired through non-payment of fees, but the Patent Office in three years only received 97 communications from patentees, who found too late that their patents had expired. While it is true that a large number of patents expire annually from non-payment of renewal fees, the Committee has no evidence before it to show that the lapse is caused by inadvertence.

The great majority of patentees know that once a patent has expired, it can only be revived by means of the cumbersome and expensive procedure of a private Act of Parliament. Only those who are ignorant of this fact, or who are of a particularly sanguine disposition, would indulge in a hopeless appeal to the Patent Office. In the last three years we have come across two cases of patents which had been allowed to lapse through inadvertence. In neither case was any communication made to the Patent Office. It is an undoubted fact that quite a considerable number of patents would be saved, were the Patent Office to send out reminders.

(*c*) In the case of trade marks there is a statutory obligation laid on the Patent Office by Section 79, Sub-section (1), of the Patents, &c., Act, 1883, to issue reminders to owners of trade marks, but there is no such obligation in the case of patents, the reason apparently being that after nearly 14 years the owner of a trade mark is reasonably entitled to official notice, but that there is no necessity to give the owner of a patent a similar notice at the expiration of a very much shorter period.

The very much shorter period is nearly four years in the case of the first payment, and one year in the case of subsequent payments. It is quite as easy to forget the payment of a fee in one year—certainly in four—as in fourteen. In many business matters where payments are made monthly it is usual to give notice that the payment is about to fall due.

(*e*) The Committee is precluded by the terms of its reference from recommending any alteration in the existing law.

The absence of statutory obligation to send out reminders, mentioned above, would, the Committee appear to think, necessitate a change in the law before reminders could be legally sent out. If this is so, it would preclude it from recommending a change; but it is no reason for a positive recommendation that no change be made.

(*f*) The Patent Office has no documentary evidence disclosing an address for service appointed by the patentee. The Register of Patents does not necessarily contain the last address of the person responsible for the payment of renewal fees. Also cases may arise where a third party may pay the fees in respect of a patent of which he is not the registered proprietor.

If the Patent Office were to notify the registered owner, they would discharge their obligation. Most, if not all, of these objections apply equally to trade marks. In any case, a system of registration of addresses of patentees could be introduced with but little extra labour or expense.

(*g*) The Chartered Institute of Patent Agents object. They urge that the work could not be done satisfactorily and reliably by the Patent Office. Patentees often rely on agents for advice as to the expediency of paying renewal fees, and agents make a practice of issuing notices to their clients before the fees become due; for this they charge a moderate commission if the fee is paid, but receive nothing if the patent is abandoned. Agents have frequently a general authority from clients to act on their behalf in the matter of payment of fees, which may involve questions of more importance than the mere payment of the fee, *e.g.*, the maintenance of an unprofitable patent in the United Kingdom may be expedient in order to keep alive the same patent which is being profitably worked in a foreign country. For this purpose agents have to keep carefully prepared books and employ a special staff.

With all due respect to patent agents as a class, the Patent Office could do the work quite as satisfactorily as they do. In both the cases mentioned above of patents lapsing, the inadvertence was on the part of the agent, who, despite his carefully prepared books and special staff, may occasionally need reminding himself. Patentees could still rely on their agents for advice, and the agent could still pay the fee and earn his moderate commission. Why the agents object we do not see. We do not believe it is because they are afraid that they might lose their commission; we do not think they would. The reasons given above scarcely justify them in objecting. The Committee seem to have left out of consideration the quite appreciable number of patentees who do not employ agents; doubtless the agents ignored them, too, in giving their evidence.

(*h*) The patent agents contend that if the Patent Office were authorised to send out reminders, it would also be forced to assume the responsibility of advising as to the effect of non-payment, and especially the result likely to follow from lapsing of a master patent on those of a subsequent date.

This contention is absurd and unmaintainable, both from a legal and moral point of view.

The Committee was precluded by the terms of its reference from making any recommendation as to the introduction of a cheaper method of reviving lapsed patents. We remain totally unconvinced by the reasons given by the Committee for their conclusions on this point.

No. 3.—There are about 8,900 specifications of expired patents which are out of print, and the number is increasing annually. Copies of these are often wanted, chiefly in connection with legal matters. The Committee makes the sensible recommendation that the Comptroller-General be authorised to reprint such of these as there is a demand for. They suggest that it should only be done on the understanding that the applicant will take not less than six copies at the usual price of 8d. each, discretion being reserved to the Comptroller-General to refuse to reprint where he considers it undesirable. The suggestion is a good one, and the restrictions reasonable.

No. 4.—The deposit accounts if successful are intended to supersede the post card system of payments. The regular purchaser, such as the country patent agent, will doubtless prefer the new method, and the occasional purchaser the old.

No. 5 recommends the extra grant of a trifling sum of £300 for three years for books and binding, and the immediate expenditure of another £300 for books already selected, but which cannot be purchased from lack of funds; comment is needless.

The proposals entail an increased expenditure for 1900-1 of £3,125, not a large amount when one considers the useful purpose which the Patent Office carries out, and the sum which ought to be expended on it to enable it to fulfil that purpose to the best advantage.

RAILWAY RATES AND CHARGES FOR ELECTRICAL MACHINERY AND APPARATUS.

[COMMUNICATED.]

One of the points in connection with the manufacture of electrical machines and apparatus which has apparently been overlooked is the very high rates charged by the railway companies for the despatch of the various machines used in connection with electricity supply. These charges are very important, both from the manufacturers' and contractors' point of view, and if they were examined carefully, it would be seen at once how very excessive they are, especially when the sale prices have been cut down to the lowest figure.

It seems peculiar that after manufacturers making a special effort to reduce expenses in the manufacture, and paying large sums for labour-saving machinery, they should leave this very important matter more or less out of the reckoning.

Consulting engineers, however, seem alive to the importance of this, as in nearly all specifications it is specified that the prices quoted are to include delivery at the works.

In all other industries, as the result of persistent agitation by the manufacturers, special low rates have been quoted for many things, but there is hardly one special rate quoted for any one instrument or machine used in the electrical industry; in fact, it might be said to be non-existent as far as the railway companies are concerned.

All goods known to the railway companies are classified under the different headings, and divided into five classes, the first-class rate being the cheapest, and the charges increasing till they reach the maximum at fifth class. Besides these, there are several other rates which are used for traffic which occupies a large space, or which requires a whole truck to itself.

In this classification book, which is issued by the Railway Clearing House, and can be obtained by anyone for 1s., there are not 12 electrical instruments named, but with the exception of these few, accumulators, batteries, dynamos, arc lamps and transformers, they are all charged under one heading, viz. :—Electrical instruments for electric lighting and power at fourth class.

Even such common instruments as meters are not named, although gas and water meters are provided for (these go at third class), so, of course, they are charged at nearly the highest rate possible. Not a word is said as to the numerous other instruments. This is a serious matter and requires looking into at once, considering the large number of this kind of instruments forwarded.

Again, there ought to be special rates for such articles as glow lamps and electrical fittings, as there must be an enormous traffic in this class of goods.

The way to remedy this state of affairs is for all manufacturers to combine and draw up a list of the different apparatus made, and endeavour to persuade the railway companies to quote rates. It is of no use for one or two firms to take it in hand. The manufacturers may be trusted to see that the rates are fair and reasonable.

The way the few articles are at present provided for by the railway companies might be improved upon. For instance, arc lamps are now described as follows :—Arc lamps (excluding globes or carbons) in parts, in cases, fourth class; arc lamps, in parts (except otherwise provided for), fourth class. Of course, there is no difference whatever, and *they can therefore all be charged at fourth class.*

This is only an instance of the way in which the railway companies charge, and it would, therefore, be of advantage when steps are taken to obtain new rates, to see that there are no cases like this.

The trade is now of such importance from the railway companies' point of view, that they would only be too glad to meet the manufacturers if they were approached on the subject in a proper manner, as they cannot be supposed to know what is required unless it is put before them.

The railway companies' method of charging, and the number of ways by which goods can be charged, is so complicated, that it requires someone who has a good knowledge of railway methods of charging to understand them. The ordinary clerk who usually checks the accounts (if they are checked at all) cannot help passing items, which, if dealt with properly, would be found to be charged wrong; the most curious part of it is that the railway companies benefit by these mistakes in nearly every case.

It would pay every manufacturer, whether large or small, to see before settling accounts that they have been properly examined by a competent clerk. In checking the accounts it should be seen first whether the goods *have* been forwarded or received, as the case may be, as very often items are charged twice; the weights should then be carefully examined, as often they are put down a cwt. more than they really weigh (quite accidentally of course). In examining the rates it is easy to see if they are correct, as the classification book referred to gives the class, and the railway companies' rate books are always open for inspection by the public. The charges can be calculated out or obtained from the scale of charges to be found in the classification book, which is indispensable to clerks in checking these accounts.

There are often to be found on the invoice items under the heading of "paid ons;" these should be struck off and deducted from the total, and an explanation as to how they are made up obtained, before paying, as if the goods come from a distance there are not always rates "through;" they are then booked to the place where there *are* rates, nearest to destination, and then re-booked; thus there is a double charge.

All overcharges should be deducted from the accounts before paying; the writer has deducted, and the railway company have allowed more than half the total amount of the accounts, and not one week in the year passes but there is a substantial amount to be deducted.

If these directions are followed carefully, there will be found to be a saving of nearly 50 per cent., which is certainly worth considering, as carriage is really a dead loss.

Another point which appears to call for more attention than it at present receives is to consider which would be the most economical way of forwarding goods with safety. All goods, sent in small lots, up to 28 lbs., would go cheapest by passenger train, and should, especially if the instruments are what might be termed delicate, always be so sent. This, as far as experience goes, is generally done, but proper attention is not given to the labelling.

It may not be generally known, but goods sent labelled "glass," "fragile," and delicate instruments, with care, are charged 50 per cent. over the ordinary charge, while this might be avoided by simply labelling them as "Electrical instruments with care," and answer the same purpose.

It will also be of advantage if the manufacturers sign what is known as a "General risk note," whereby the sender takes the risk of breakage, &c., under the usual conditions, as, with proper representation to the railway companies, a large number of instruments, such as meters, ammeters, voltmeters, testing sets, &c., can be sent at half rates. This is a consideration, and in the writer's experience this course has resulted in a large saving.

If strict attention is paid to careful packing, there need not be any fear of breakage occurring, unless the goods are wilfully damaged, when compensation can be obtained for it.

Another great thing in forwarding goods is to deal direct with the railway company, and not with the different carting agencies; this will be found to be much cheaper and better in the end, and the goods will be much less liable to delay or damage. It is a well known fact, that although the railway companies are rather slow in settling claims made upon them, these carting agencies are much more so, while if goods are lost in transit,

it is much better and expedites matters considerably to have only one party to deal with, and, of course, if the railway company have the goods handed them direct, there is less chance of anything happening to them.

The rates for raw material also require special attention, as mistakes in charging the correct rates are bound to be made, as some of the materials used in the trade are not well known to the railway companies.

One thing requiring immediate amendment is the practice of some firms paying the carriage "on delivery," as this does not give a chance to see if the charges are correct, or if the goods are damaged in any way. If the firm has not an account with the railway company, one should be opened. Before signing, the carmen's delivery sheet should always be endorsed "not examined" if the goods cannot be unpacked in his presence. This prevents any dispute afterwards when the claim is made, as they decline to pay any claim if they hold a clear signature.

When goods are found to be damaged, an intimation should be sent immediately to the railway company, with a request that they will send a representative to inspect the goods; at the same time an estimate of the cost of damage should be enclosed. This will have the effect of ensuring an early settlement of the claim. The damaged goods should never be repaired or put away till they have been inspected, as otherwise the railway company may decline to pay the claim on the ground that they have no proof that the damage really occurred. There need be no delay in having claims settled promptly by the railway companies if these points are observed.

HORSE AND ELECTRIC TRACTION AT GLASGOW.

We venture to believe that no British (we had nearly said English) tramway report has yet been made to speak so eloquently against horse traction and in favour of electricity as that which has been issued by the Glasgow Tramway Committee for the year ended May last. The operations of the past year, as there outlined, show beyond the shadow of a doubt that electric traction is cutting the ground from beneath the feet of the horse. The great work of the year has been the carrying forward of the large scheme under which the entire city lines will be operated by the electric trolley method, and this has to some extent interfered with the ordinary traffic, occasioning certain unavoidable interruptions. But notwithstanding this, the working resulted in an improvement shown in the following table:—

Year.	Gross revenue.	Working expenses.	Gross balance.
1898-99	£439,224	£318,105	£121,118
1899-1900	469,965	344,721	125,243
Increase	£30,741	£26,616	£4,125

The electric traction section total receipts were £53,711, and the working expenses £24,252, leaving a balance to net revenue of £29,459. The proportion of working expenses to receipts is 45 per cent.; but taking the horse results, receipts £416,253, less working expenses £320,468, there is a balance to net revenue of only £95,784, making the percentage of working expenses to receipts nearly 77 per cent. These calculations do not include certain large sums for interest on capital, sinking fund and depreciation. After such payments have been made £12,500 is set apart for the "common good," and £46,568 is transferred to general reserve fund.

The horse sections have suffered heavily in the way of expenditure by a serious attack of glanders which appeared in July last, and the price of food stuffs has increased by 5·37d. per horse per week. This item cost 7s. 8·60d. per horse per week for a stud of 4,411 horses. It is rather curious to note that although electric traction is being adopted throughout, the stud shows an increase of 81 horses for the year, but this is accounted for by the fact that extensions are being made all round, and there is an increasing demand for a closer service on all routes. In all probability the 1900 or 1901 accounts will begin to show a very marked diminution in the number of horses. There are at present only 47 electric cars running, but 132 are ready for service, having been constructed and equipped at the Corporation's own car building works at Coplawhill. Twenty-seven more are constructing, and orders have been placed outside for 80 car bodies which will be electrically equipped at Coplawhill. The experiment of electrically equipping the old horse cars appears to have been tried, for one is reported to have been so equipped "with satisfactory results."

The present system extends over about 41 miles of double and 1 mile of single track = 83 miles of track. At May 31st, 1900, 15 miles of double track had been renewed for electric traction, and as other 17 miles are either new or have been recently renewed, and as the rails are quite suitable for electric traction, this only leaves 6 miles still to be renewed. Five miles of double track are now being worked electrically. The work of laying the ducts for the feeder cables is almost finished, and contracts have been placed for the feeder cables and also for the overhead equipment. It is anticipated that a large service of electric cars will be ready early in 1901.

The gross capital expenditure has been £1,061,339, but since 1894 depreciation has been written off this sum to the tune of £124,306, leaving the capital account at £937,033.

The electric car revenue has been maintained at nearly 14d. per car-mile, and the horse cars have earned 11·30d., and this, as we have already said, is in spite of the interruptions caused by the track conversion operations.

In view of the trouble with car mishaps which have arisen in several places, due to careless or inexperienced drivers, it is satisfactory to find that "arrangements have now been made for the systematic training of a sufficient number of our present staff as motormen." For this purpose a skeleton school car has been built, and the men are being put through a course of instruction, not only in driving an electric car, but also in the details of the electrical equipment. The men are paid the usual wages while receiving this tuition. This is an excellent feature of the Glasgow report, and it is well worth the attention of other Corporation tramway managers who, like Mr. Young, are anxious, when the electrical service comes into full swing, to avoid the unfortunate experiences which have happened in some places.

It is only to be expected that the Tramway Committee will conclude their report with words recording their gratification at the continued success of the department, and particularly at the extremely satisfactory results which have attended the introduction of electric traction. Their high appreciation of the services of the popular general manager, Mr. John Young, and his staff, is well-deserved and freely given.

An analysis of the accounts is not an easy matter in view of the necessary mixing up of horse and electric figures to a certain extent, but there is one figure which attracts our notice. The amount of depreciation written off the entire system is £32,079 for the year. Horses alone are respon-

Electric Traction.

—	Average cars (16-hour day).	kw.-hours.	Mileage.	Passengers carried.	Receipts.			Aver. receipts per mile.	Average kw.-hours per mile.
Year to May 31st, 1900 ...	27·82	1,165,749	927,870	14,825,858	53,611	13	3	13·87	1·26
Year to May 31st, 1899 ...	18·57	545,830	397,470	6,188,981	23,003	15	8	13·89	1·37

sible for £13,441 of this, and the average value placed upon the 4,411 horses is £20 apiece. The small amount of electrical equipment is responsible for £1,885, machinery and plant £1,229. We fancy the depreciation item in the accounts for 1902 or 1903, when everything is electrical, will be just a wee bit under £32,079. In the abstract of accounts, the figures which appear at the bottom of the preceding page are given regarding the working of the electrical section for the two years.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1900.

Compiled expressly for this Journal by W. P. Thompson & Co. Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester and Birmingham, to whom all inquiries should be addressed.

11,471. "Improvements in electro-magnetic brakes." H. E. Walter. Dated June 25th.

11,486. "Improvements in means for preventing sparking in electric switches, commutators, current conductor contacts, contact breakers, and other devices." J. V. Sherrin. Dated June 25th.

11,500. "Improvements in arc lamps." P. H. F. Spies. Dated June 25th.

11,504. "An improved process for fitting submarine cables for quick signalling." H. E. Kettler. Dated June 25th. (Complete.)

11,512. "Improvements in telegraphic receiving and translating arrangements." A. Muirhead. Dated June 25th.

11,516. "An improved electrical apparatus for the painless extraction of teeth, or the like surgical operations." L. Roubien and L. Besse. Dated June 25th.

11,519. "Improvements in frogs to be used in connection with overhead conductors of electrical tramways and railways." H. G. Nicholson. Dated June 25th.

11,547. "Improvements in fittings for overhead trolley systems of electric tramways." G. Hill. Dated June 26th.

11,556. "Improvements in terminals and supports for Nernst lamp glowers." M. W. Hanks. Dated June 26th. (Complete.)

11,557. "Improvements in ballast resistances and cut-outs for Nernst lamps." H. N. Potter. Dated June 26th. (Complete.)

11,558. "Improvements in systems for lighting by Nernst lamps." A. J. Wurts. Dated June 26th. (Complete.)

11,559. "Improvements in starting apparatus and cut-outs for Nernst lamps." A. J. Wurts, M. W. Hanks, and H. N. Potter. Dated June 26th. (Complete.)

11,560. "Improvements in terminals, connections, and supports for Nernst lamps." A. J. Wurts and M. W. Hanks. Dated June 26th. (Complete.)

11,561. "Improvements in Nernst lamps and heaters therefor." A. J. Wurts, H. N. Potter, E. Bennett and M. C. Beebe. Dated June 26th. (Complete.)

11,562. "Improvements in electric lighting." P. C. Hewitt. Dated June 26th. (Complete.)

11,571. "Improvements in battery compounds." H. J. Blumenberg, jun. Dated June 26th. (Complete.)

11,584. "Improvements relating to incandescent electric lamps." C. Paulthonier. (Date applied for under Patents, &c., Act, 1883, Sec. 103, March 30th, 1900, being date of application in France.) Dated June 26th.

11,588. "Improvements in electric railway systems. G. E. Kent. Dated June 26th.

11,597. "Improvements in flexible conduits for electrical conductors." H. G. Osburn. Dated June 26th. (Complete.)

11,609. "Improvements in means for protecting electrical apparatus from abrupt changes in static potential." P. H. Thomas. (Date applied for under Patents, &c., Act, 1883, Section 103, November 27th, 1899, being date of application in United States.) Dated June 26th.

11,610. "Improvements in means for protecting electrical apparatus from abrupt changes in static potential." P. H. Thomas. (Date applied for under Patents, &c., Act, 1883, Section 103, November 27th, 1899, being date of application in United States.) Dated June 26th.

11,620. "Improvements in dynamo-electric machines and electric motors." H. F. Joel, sen. Dated June 26th.

11,643. "Improved switch for lampholders." F. Rawlings. Dated June 27th. (Complete.)

11,659. "An improved cut-out plug." M. Haase and E. Roder. Dated June 27th. (Complete.)

11,677. "Improvements in apparatus relating to the parallel running of alternate current machinery." H. C. Leake. Dated June 27th.

11,692. "Improvements in or connected with electrical tramways or railways." H. G. Nicholson. Dated June 27th.

11,695. "Improvements in alternating current wattmeters." W. L. Wise. (The Union Elektricitäts-Gesellschaft, Germany.) Dated June 27th.

11,704. "New or improved electric brush-holder." W. E. Burnand. Dated June 28th.

11,709. "Improvements in the construction of electric lamp pillars." Hardy and Padmore, Ltd., and J. Southall. Dated June 28th.

11,720. "Improvements in or relating to electrical ignition apparatus for exploding the charges in internal combustion motors, and for other similar purposes." H. T. Dawson and H. A. Dawson. Dated June 28th.

11,727. "Improvements in or connected with electric switches having intermittent or step-by step motions." W. Kingsland. Dated June 28th.

11,768. "Improvements in electric light brackets or fittings." J. F. Cornuand. Dated June 28th.

11,787. "Improvements in electrical starting and regulating switches." A. H. Hickley. Dated June 29th.

11,797. "Improvements in regulating devices for alternating electric current circuits." The British Thomson-Houston Co., Ltd. (E. Thomson, United States.) Dated June 29th.

11,808. "Improvements in automatic switches for telegraph and telephone circuits." L. Cerebotani and C. Moradelli. Dated June 29th. (Complete.)

11,812. "An improved method of fixing the china or other insulator and also conducting wire in sparking plug for ignition by electricity for gas or explosive vapour or oil engines." A. M. Hart. Dated June 29th.

11,814. "Improved means of connecting terminal ornaments to tubular poles and the like." P. Austin. Dated June 29th.

11,819. "An instrument for measuring rotary field currents." Siemens Bros. & Co., Limited. (Siemens & Halske Aktien Gesellschaft, Germany.) Dated June 29th. (Complete.)

11,824. "Improvements in telegraphy and apparatus connected therewith." A. Bull. Dated June 29th. (Complete.)

11,825. "Improvements relating to electrical installation and distribution." J. F. Smith. Dated June 29th.

11,835. "Improvements in electro-pneumatic controlling apparatus." E. R. Hill. (Date applied for under Patents, &c., Act, 1883, Sec. 103, January 13th, 1900, being date of application in United States.) Dated June 29th.

11,840. "Improvements in means for preventing sparking in electric switches, commutators, current conductor contacts, breakers, and other electric devices." J. V. Sherrin. Dated June 29th.

11,853. "Improvements in and relating to flag or banner poles, or for use in connection with arc lamps or for other like purposes." J. K. Grindrod. Dated June 30th.

11,861. "Improvements in or connected with secondary batteries." R. Kennedy. Dated June 30th.

11,866. "Improved means for coupling wire cables." F. Durden and E. Froggatt. Dated June 30th,

11,869. "Electric generators for military and other cycles." H. V. Weyde. Dated June 30th.

11,891. "Improvements relating to electric traction for tramway and other similar vehicles." A. Baisieux. Dated June 30th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, price, post free, 9d. (in stamps).

1898.

16,734. "Improvements in electric locks and combination mechanism therefor." P. A. Newton. (H. G. Carleton.) Dated August 2nd, 1898. Relates to a latch or lock electrically controlled from a distance, and adapted to give an alarm when tampered with, the lock being specially suitable for the front door of apartment houses. An electromagnet is mounted on a spring frame, which can be operated from the outside by a knob spindle and follower. A spring bolt is separate and carries an armature. Normally the operation of the knob spindle has no effect on the bolt, the magnet and frame reciprocating idly, but when an operator in charge completes the magnet circuit at some distant point, the retraction of the frame and magnet causes the armature and bolt to move also, and the door is unlocked. The circuit is made through spring contacts in the door and frame. Two alarms, &c., are placed in multiple circuit with the main circuit, one near the lock and the other near the operator's station, these both sounding when the circuit is completed, notifying both the visitor and the operator that the lock is ready to be operated. The opening of the door breaks the circuit and stops both alarms, thus notifying the operator that the door has been opened. Slight modifications of the arrangement of magnet and armature may be made, and the magnet may operate the striking plate instead of the bolt. An electric combination mechanism may also be applied to the lock or to any form of electric lock. 29 claims.

16,558. "Improvements in galvanic batteries." A. J. Benedict. (W. S. Dos.) Dated July 29th, 1898. Relates to portable sealed batteries adapted for use with lamps for vehicles, &c. A vulcanite casing is divided by vertical partitions into cells in each of which is a perforated cylindrical zinc electrode surrounded by a perforated tube of vulcanite which is in turn surrounded by a perforated carbon electrode, held in place by pieces of celluloid placed between it and the perforated tube, or the lower end of the carbon may rest on a flanged plug screwed into the lower end of the perforated tube. The connection from the zinc is made by a thin platinum wire arranged so that the lower end of the zinc always rests on the wire. The cells are closed by a cover in which are apertures closed by plugs, but in place of these the cover may be made to slide or revolve so that the apertures in it may be made to coincide with the centre of the cell when it is required to remove the zinc. A gas exit permits the escape of gas but not of liquid. 4 claims.

16,595. "Improvements in electric heaters." H. Lyon. Dated July 30th, 1898. A rectangular or cylindrical block is moulded with a continuous groove, from a mixture of fire clay and lampblack, and fired. The groove is filled with a mixture of carbon, vegetable fibre treated with sulphuric acid, lampblack, blacklead and sugar, and baked, a resistant conductor being thus formed. Or a resistant metal wire may be wound in the grooves. The ends are connected to terminals on a plate, and the resistance enclosed in a steel casing. The spaces are filled up by evaporating brine in them, or with a mixture of silicate and carbonate of soda, and either lampblack, mica, or talc; or mica or talc alone may be used. 1 claim.

16,659. "Electrolytic process for extracting metals from their halogen combinations." Dr. E. Holberg. Dated July 30th, 1898. Relates to obtaining metals from their halogen salts. The halogen salt, for example, carnallite, when it is desired to obtain magnesium, is fused, and then transferred to an electrolytic tank, which may contain a large number of electrodes. The fused electrolyte is covered over by a refractory and non-conducting material, such as asbestos. Above the asbestos a vacuum may be formed, or an inert gas substituted for the air originally present. 4 claims.

16,716. "Improvements in systems of electrical distribution." The British Thomson-Houston Company, Limited. (C. P. Steinmetz.) Dated August 2nd, 1898. Relates to a method of obtaining multiphase currents from a single-phase circuit. Motors or generators are connected across the mains in series to produce the desired effect. An ordinary generator supplies the mains, and in order to obtain a polyphase current to drive motors, two machines preferably synchronous motors are connected in series. A third wire is connected to the intermediate point. 2 claims.

16,716. "Improvements in systems of control for electrically propelled trains." The British Thomson-Houston Company, Limited. (E. W. Rice, jun.) Dated August 2nd, 1898. Electric locomotives and motor vehicles are equipped to run separately or to be controlled from a single point when coupled in a train, so that the motor equipments on the different vehicles can be run in series or in parallel. A single cable connects the two cars, which have the usual motors, trolleys and controllers, and ground connections. A switch is set to make the ground connection on one car, and then the driver at the controller can set the switch to couple the two sets of motors in series, or he can set it to earth so that the motors then run in parallel. 7 claims.

16,717. "Improvement in trolleys for electric railways." The British Thomson-Houston Company, Limited. (F. E. Case.) Dated August 2nd, 1898. Relates to collectors for electric railways and tramways on the overhead system. The trolley pole socket, forked at its lower end, straddles the casting, to which it is pivoted below the centre line of a spring. This casting swivels on a stud on the base which has a socket for the wire leading to the motors. The spring guided on a tube attached to the casting bears on the cam-shaped end of the pole-socket to lift it, and also acts as a buffer when the trolley flies off the wire as it bears on the cross head attached by side rods to lugs on the pole-socket. A stop nut on the tube limits the motion of the cross head. 6 claims.

16,754. "Improvements in coin-freed apparatus for the automatic delivery of electric current." C. Sieberstein. Dated August 2nd, 1898. For each payment the current is allowed for a definite time, which may be taken continuously or be divided up as desired, the clock which finally switches off the current being also started and stopped by a hand switch. The automatic action depends on a spring detent which is opposed to a pinion on another wheel of the motor. At the end of the permitted period the clock lifts and drops the detent, so that the motor runs till the disc has turned through the angle between the notches, switches off the current and applies a finger to the balance wheel of the clock. The coin drops into a pan at one end of a beam which gives unstable equilibrium to a cam on a fulcrum, but is normally kept in the position by means of a counterweight and a stop pin. Also when the current is on, one of a couple of pins on the notched disc supports the cam. When the current is off, a coin upsets the beam and the cam lifts the detent, so that the motor switches the current on and re-sets the cam and beam. The pan is hinged to the beam, so that on descent it is tipped by a fixed pin. 2 claims.

16,834. "Improvements in means for the automatically regulated charging of electrical accumulators." C. U. E. Peterson. Dated August 3rd, 1898. Relates to means for the automatic charging of secondary batteries in systems of electric distribution. When the charging is effected by primary batteries the circuits are connected to the positive and negative poles of a cell of the accumulator battery, which is closed except for a plug through which are three passages, two of which are respectively connected with bent tubes which contain mercury, while the third is connected with the air through tubes and a spring valve which is forced open by an armature when the latter is attracted by an electro-magnet. As the battery becomes charged, the gases evolved in the cell cause the mercury to be depressed in the inner members of the tubes, and raised in the outer members, whereby the connection between the two wires connected to the tube is broken, while that between the two wires connected to the second tube is made, whereby the charging is arrested and the electro-magnet and glow lamp are thrown into the working circuit, which becomes operative when the switch is turned through a quarter of a revolution, and the valve in the tube being opened the mercury in the tubes sinks to its normal position. When the battery becomes exhausted, which is indicated by a lamp becoming extinguished, the switch is turned through a further quarter revolution and the charging process begins anew. If the battery is charged by a thermo-electric battery, the plug has a fourth opening in it whereby the pressure of the gas in the cell operates to turn off the cock of the burner by which the pile is heated. When the accumulator battery is charged by a high tension current from a central station, a multiple circuit switch is used instead of the switch. It consists of two porcelain discs insulated from each other and mounted on a pivot so that they turn together. The discs are each provided with teeth, in number four times that of the number of the cell groups, and with these teeth engage spring contacts from terminal screws fitted in the base of the switch. The two discs have different brass covering conducting strips indicated by section lines, and the discs can be held in any position by means of a spring. 2 claims.

16,871. "Improvements in coupling arrangements for connecting electric wires." A. Shiels. Dated August 4th, 1898. Relates to couplings for use on railway vehicles in connection with the couplings for air or vacuum brakes. The general arrangements for wiring may be as described in Specification No. 1,096, A.D. 1892. In one form, one of the conductors is led through a hollow plug carrying an insulating block to a spring contact adapted to engage a similar contact in the other half of the coupling. The other conductors make the contact through the metal parts of the coupling, one of which is preferably provided with a brass strip engaging with a brass stud on the other. In a modified arrangement the spring contact is fitted with a guard so that it cannot be bent and forced into contact with the walls of the tube or coupling. In a further modification the spring is supported by a ring which can be slipped in or out of the coupling. One adaptation to a Westinghouse brake coupling is described. The conductor is connected to a contact stud mounted on an insulating block fitting in a sliding sleeve. 3 claims.

16,876. "Improvements in secondary batteries or accumulators." E. J. Clark. Dated August 4th, 1898. The positive plates are suspended at each end by hooks which pass over insulating rods supported by the negative plates. Glass separating rods are also suspended from the insulating rods and are prevented from swinging by insulating rods held by hooks or claws formed on the negative plates. 3 claims.

16,902. "An improved electric motive mechanism for clocks and the like." H. H. Lake. (Societe Anonyme des Horloges Electriques Cauderay.) Dated August 4th, 1898. A ratchet wheel is driven by the pawl pivoted to the lever armature of an electro-magnet having a spring acting against it. Contact is made and broken between the driving pawl and the screw in the check pawl. 2 claims.

16,908. "Improvements in electric, telegraphic or telephonic apparatus." W. Nahorsky. Dated August 4th, 1898. Relates chiefly to the use of telephones as intermediate telegraph receivers and transmitters. The signals are transmitted by means of a key, induction coil, and a microphone and telephone receiver so placed in opposition as to mutually affect each other. A switch is arranged to vary the circuits for telegraph transmitting and receiving, and also for using the telephone instruments as telephones. A modification is described by which a second set of telegraph instruments may be arranged in parallel, so as to use both telegraph and telephone instruments simultaneously. The instruments are mounted on adjustable supports, or may be built as one instrument with the receiver when it is not desired to use the line for telephony. 4 claims.

16,972. "An improvement in jointing boxes for coupling up and insulating electric wires." T. McEwan. Dated August 6th, 1898. Metal cases with screwed openings for receiving the ends of the conduits, are closed by screwed down lids fitted with gasketing. The conductors are connected by a coupling, the joint being enclosed in an india-rubber bag. The mouth of the bag may be contracted and is closed on to the rubber insulation of the cables. 1 claim.

16,999. "Improvements in or relating to electric accumulators." Dr. E. Andreas. Dated August 6th, 1898. Relates to terminals for the strips which connect together plates of like polarity. A tubular socket is connected at its lower end to one of the strips, so that when surrounded by a rubber tube, a space is left which is filled with oil to prevent creeping of the acid. Connection is made with this socket by a wire connected to the upper part of a plug fitted in a wooden handle. 2 claims.

17,013. "Improvements in dynamos." H. J. Walker. Dated August 6th, 1898. For the purpose of preventing sparking at the collecting brushes and distortion of the magnetic field by armature reaction, the field magnet poles are made narrow and near together, and instead of being arranged parallel to the axis of the armature, they are inclined thereto so as to extend in a spiral or screw-like fashion, partly round the same. With this arrangement, each armature coil at the moment of commutation will be partly under, and be subject to the differential action of two adjacent and dissimilar field magnet poles. Each of the four magnets is more or less U shaped, and has two pole-pieces, inclined with reference to the armature axis, the adjacent pole pieces of each pair of magnets being of the same sign. In the form described, the pole-pieces are cast in one. The other half of the machine is similarly constructed. The coils are placed on the cores formed by the adjacent pole-pieces. 3 claims.

17,026. "Improvements in or connected with electric meters." H. Reason and the Mutual Electric Trust, Limited. Dated August 6th, 1898. Relates to quantity meters. A motor meter has a rotating disc of large diameter immersed in mercury between cylindrical pole-pieces, a closed space being formed by hard rubber rings and a metal ring through which the current to be measured passes into the mercury. The disc spindle is geared to a counter. A cap is used to cover the mercury space during transit. The pole-pieces are attached to square iron plates and are surrounded by a coil carrying the current. Two parallel magnetic circuits are formed by a rod connecting the plates and an air-gap adjustable by a small movable piece and a screw. The rod is magnetically saturated by a shunt coil, independently of the added magnetising force of current in the main coil. Movement of the piece adjusts the compensation for starting friction. In a modified arrangement the shunt coil surrounds one of the pole-pieces, and is movable towards or from the armature space to adjust the compensation, the air-gap being made non-adjustable. 4 claims.

17,090. "Improvements in electrical transcribing apparatus." E. A. Hummel. Dated August 8th, 1898. (Date claimed for patent under Sec. 103, Act, 1883, January 10th, 1898, being date of application in United States.) Facsimile or copying telegraphs are arranged with motor driven cylinder both at the transmitting and receiving stations. The transmitter is provided with a copy in insulating ink, such as shellac on a metal surface, and this is traversed by a style mounted in a guide and is moved forward by a screw after each revolution of the cylinder. A locking disc is provided with a detent notch, a contact block with a recess for momentarily breaking the main line circuit at each revolution, and a pawl for operating one of the spur wheels having differing numbers of teeth on the screw shaft. In the receiving instrument the recording style is operated by a local relay circuit containing an electro-magnet, and the releasing arm is also provided with an electro-magnet. The relays are reversed so as to produce a positive record. 2 claims.

17,145. "Improvements in means for advertising." W. F. Smith. Dated August 9th, 1898. Advertisements are put on both sides of the top or crown of a hat, the top, which is hinged, being adapted to be opened by a cord operated by the wearer. The top is preferably double, and of transparent or translucent material to enclose an incandescent or other lamp, by which it may be illuminated. The lamp may be automatically lighted when the top is opened. 3 claims.

17,161. "Improvements in and connected with automatic electric switches." F. C. McMillin. Dated August 9th, 1898. Relates to automatic switches for opening and closing a lamp circuit at predetermined times. A switch lever pivoted at one end is actuated by means of armatures of a double wound magnet, such armatures being connected to each other by a stem and to the lever by spring controlled links. Switch or contact blades insulated from one another, are mounted upon a rod connected to the lever which also carries a contact rod designed to connect two contact pieces placed in the line circuit. The blades make and break contact at predetermined times, with spring-plates in the lamp and line circuits respectively. Upon the hour stem of a clock are two dials having suitably placed recesses for receiving projections on spring controlled levers which carry insulated contact rolls or plates. When the projection on one of the levers is released, the roll or plate on such lever completes the circuit between a contact plate and a corresponding piece, so that the solenoid energises the magnet core and thus causes the lever to operated. As soon as the lamp circuit has been closed, the rod leaves the pieces and so breaks the magnet circuit. The length of time during which the lamps are to burn may be regulated by relatively adjusting the dials. 5 claims.

17,163. "Improvements in sound transmitting, recording, and reproducing apparatus, applicable to telephones, gramophones, and the like." W. P. Thompson. (E. Berliner and J. Sanders.) Dated August 9th, 1898. Sound recording and reproducing apparatus, such as phonographs, telephones, &c., are provided with large thin diaphragms combined with a short light spring which has its free end preferably attached without strain to the centre of the diaphragm by means of beeswax or solder. The spring is extended outwardly, and is connected to the pivoted lever carrying the stylus. The lever is mounted on a short coned axle bearing in inverted conical openings in the uprights. The space between the uprights is adjusted by a screw rod provided with nuts and lock nuts. A spiral spring attached to an arch may be substituted for the leaf spring. 8 claims.

17,191. "Improvements in or connected with overhead conductors for electric railways and the like." J. C. Schafer and J. Lorintz. Dated August 9th, 1898. Relates to means for automatically interrupting the current in suspended wires for electrical railways and the like in the case of breakage of a wire. The wires are secured to triangular frames which pass freely through holes in an insulating block. Electrical connection between the wires is effected by means of a plate secured to the block and provided with curved arms which press upon the wires. When a wire breaks, the corresponding frame and adjoining parts of the wire fall away from the arms. In a modified form the plate has arms which bear against the frames. In other forms there is no insulating block and the wires are secured to bent metal pieces which are held against fixed pins by the strain upon the wires; in these forms the wires, when broken, fall to the ground. In another form having no insulating block, the expanded ends of the wires are detachably fitted within caps connected together; in case of breakage the wires fall from the caps. The means described may be protected by waterproof coverings. 4 claims.

17,268. "Improvements in secondary batteries or electrical accumulators." O. Behrend. Dated August 10th, 1898. The space between the electrodes is filled with glass in the state of a fine grained powder, which holds in place sufficient of the electrolyte to permit of the proper action of the battery. 1 claim.

17,371. "Improved electric battery and bell combined." G. Markt. Dated August 10th, 1898. An electric bell and a battery are combined in one piece of apparatus. A cylindrical casing containing the dry battery is screwed at each end to engage the base and the cover. The cover carries metal plates connected with the bell mechanism and bearing against spring contacts on the battery, and attached to the conductor. The bell forms a cover for the article. The cover may be castellated and the casing scored to represent loopholes, and the conductor may be wound around it and the push supported by a hook on it when the apparatus is used as a table bell. 1 claim.

17,458. "Improvements in primary batteries." A. A. Beadle. Dated August 18th, 1898. Relates to batteries in which iron is the positive electrode and carbon is preferably the negative electrode, but copper or other suitable metal may be substituted for the carbon. The iron is placed in a porous cell, and is surrounded with an electrolyte consisting of a solution of ferrous chloride or of alkaline chlorides. The carbon is placed outside the porous cell and in a glass vessel, and is surrounded by a depolarising mixture consisting of a solution of ferric chloride, chromic acid, or other oxidising solution, or of a mixture of ferric chloride and manganese dioxide. The depolarising mixture can be regenerated by re-oxidising it by suitable means. 3 claims.

17,507. "Improvements in or relating to switch devices for electric tramways." Dr. E. Andreas. Dated August 31st, 1898. Relates to electric railways and tramways worked on a mixed power system with overhead or other conductors and with accumulators. When the collector arm is lowered to disengage it from the line conductor, a switch consisting of segments comes into contact with the insulated spring arms, thereby cutting out resistances through which the lamps and battery were supplied with current and at the same time completing the circuit from the battery to the lamps and motor. 4 claims.

22,027. "Improvements in and relating to electricity meters." P. W. Northey and The Electric Motive Power Company, Limited. Dated October 19th, 1898. Relates to ampere-hour electricity meters. Consists of an instrument for recording the amount of charge left in or given to an accumulator in which clockwork or an equivalent device actuates a dial which records miles or kilowatt hours, and mechanism varies the speed of the recording device in a ratio proportionate to the rate of discharge or charge as indicated by the ampere measuring device, and to the ascertained variation of capacity consequent to such rate for a given battery. 6 claims.

24,051. "Improvements in electric switch mechanism for surface contact electric railways." J. M. Murphy. Dated November 15th, 1898. Relates to an improved electro-magnetic switch-mechanism for a surface contact electric railway system consisting of an electro-magnet having a high resistance coil in circuit through its armature lever to the contact rail and the return rail, and a low resistance coil connecting the feed wire and the conductor rail. Means are provided for energising the high resistance coil to throw the armature to close the main line or low resistance circuit and a contact common to both the low and high resistance circuits held in continuous engagement with the armature switch in its different vibratory movements. 5 claims.

26,164. "Improved means for heating by electricity." B. Tschernoff. Dated December 10th, 1898. Relates to a system of electrically conveying heat, consisting in the combination of the following processes:—(a) The transformation of a local concentrated store of solid or liquid fuel into gas; (b) the combustion of the gas in a gas engine for converting the heat into mechanical work; (c) the transformation of the mechanical work into an electric current by means of dynamo machines; (d) the distribution of the electric current to places of consumption of heat by means of electric conductors and the transformation of electrical energy into heat at the places of heat consumption by means of electric gas heaters. 2 claims.